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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Applicants	:	Xiaoxun Zhu et al.
Serial No.	:	10/712,787
Filing Date	:	November 13, 2003
Title of Invention	:	HAND-SUPPORTABLE DIGITAL IMAGING-BASED BAR CODE SYMBOL READER SUPPORTING NARROW-AREA AND WIDE-AREA MODELS OF ILLUMINATION AND IMAGE CAPTURE
Examiner	:	not yet assigned
Group Art Unit	:	2876
Attorney Docket No.	:	108-192USA000

Honorable Commissioner of Patents
and Trademarks
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. 1.97

Sir:

In order to fulfill Applicants' continuing obligation of candor and good faith as set forth in 37 C.F.R. 1.56, Applicants submit herewith an Information Disclosure Statement prepared in accordance with 37 C.F.R Sections 1.97, 1.98 and 1.99.

The disclosures enclosed herewith are as follows:

U.S. PUBLICATIONS

NUMBER	FILING DATE	TITLE
6,831,690 B1	December 7, 1999	ELECTRICAL SENSING APPARATUS AND METHOD UTILIZING AN ARRAY OF TRANSDUCER ELEMENTS
6,736,320 B1	June 16, 2003	IMAGE BASED GRAPHICAL CODE READER DEVICE WITH MULTI-FUNCTIONAL OPTICAL ELEMENT AND CONVERGING LASER TARGETING
6,708,883	April 11, 2002	APPARATUS AND METHOD FOR READING INDICIA USING CHARGE COUPLED DEVICE AND SCANNING LASER BEAM TECHNOLOGY

6,698,656	December 21, 2000	SCANNING AND DECODING CONTROL FOR AN OPTICAL READER
6,695,209 B1	October 4, 1999	TRIGGERLESS OPTICAL READER WITH SIGNAL ENHANCEMENT FEATURES
6,685,095	March 5, 2001	APPARATUS AND METHOD FOR DECODING DAMAGED OPTICAL CODES
6,681,994 B1	January 8, 2002	METHOD AND APPARATUS FOR OPTICALLY READING INFORMATION
6,669,093 B1	December 19, 1997	HAND-HELD DATAFORM READER HAVING MULTIPLE TARGET AREA ILLUMINATION SOURCES FOR INDEPENDENT READING OR SUPERIMPOSED DATAFORMS
6,637,658	January 22, 2001	OPTICAL READER HAVING PARTIAL FRAME OPERATING MODE
6,619,547 B2	April 30, 2002	IMAGE-BASED GRAPHICAL CODE READER DEVICE WITH MULTI-FUNCTIONAL OPTICAL ELEMENT AND CONVERGING-LASER TARGETING
6,565,003	June 2, 2000	METHOD FOR LOCATING AND READING A TWO-DIMENSIONAL BARCODE
6,550,679	June 18, 2001	IMAGE SENSOR MOUNTING SYSTEM
6,547,139	June 15, 2000	METHOD AND APPARATUS FOR EXTENDING OPERATING RANGE OF BAR CODE SCANNER
6,527,182 B1	April 28, 2000	IMAGE READING APPARATUS AND IMAGE PROCESSING APPARATUS
6,497,368	January 19, 1999	PORTABLE DATA COLLECTION
6,491,223	August 30, 2000	AUTODISCRIMINATING OPTICAL READER
6,489,798 B1	March 30, 2000	METHOD AND APPARATUS FOR TESTING IMAGE SENSING CIRCUIT

		ARRAYS
6,478,223	January 12, 2000	MACHINE-READABLE COLOR SYMBOLOGY AND METHOD AND APPARATUS FOR READING SAME WITH STANDARD READERS SUCH AS LASER SCANNERS
6,469,289 B1	November 21, 2000	AMBIENT LIGHT DETECTION TECHNIQUE FOR AN IMAGING ARRAY
6,435,411	April 21, 1998	OPTOELECTRONIC DEVICE FOR ACQUISITION OF IMAGES, IN PARTICULAR OF BAR CODES
6,431,452	January 30, 2001	PORTABLE DATA COLLLECTION DEVICE WITH VARIABLE FOCUSING MODULE FOR OPTIC ASSEMBLY
6,398,112 B1	March 31, 2000	APPARATUS AND METHOD FOR READING INDICIA USING CHARGE COUPLED DEVICE AND SCANNING LASER BEAM TECHNOLOGY
6,390,625	January 31, 2001	FOCUSING MECHANISM
6,385,352 B1	October 26, 1994	SYSTEM AND METHOD FOR READING AND COMPARING TWO-DIMENSIONAL IMAGES
6,371,374	November 1, 2000	ADJUSTABLE ILLUMINATION SYSTEM FOR A BARCODE SCANNER
6,367,699	September 17, 1998	METHOD AND APPARATUS FOR UTILIZING SPECULAR LIGHT TO IMAGE LOW CONTRAST SYMBOLS
6,347,163 B2	May 19, 1995	SYSTEM FOR READING TWO-DIMENSIONAL IMAGES USING AMBIENT AND/OR PROJECTED LIGHT
6,345,765	June 30, 2000	SPECTRAL SCANNER EMPLOYING LIGHT PATHS OF MULTIPLE WAVELENGTHS FOR SCANNING OBJECTS, SUCH AS BAR CODE SYMBOLS, AND ASSOCIATED METHOD

6,340,114 B1	June 12, 1998	IMAGING ENGINE AND METHOD FOR CODE READERS
6,336,587 B1	October 19, 1998	OPTICAL CODE READER FOR PRODUCING VIDEO DISPLAYS AND MEASURING PHYSICAL PARAMETERS OF OBJECTS
6,330,974	March 29, 1996	HIGH RESOLUTION LASER IMAGER FOR LOW CONTRAST SYMBOLOGY
6,298,176	October 17, 1997	SYMBOL-CONTROLLED IMAGE DATA READING SYSTEM
6,298,175	October 17, 1997	OBJECT SENSOR SYSTEM COMPRISING CONTROLLED LIGHT SOURCE
6,275,388	July 8, 1998	IMAGE SENSOR MOUNTING SYSTEM
6,266,685	September 8, 1998	HAND-HELD DATA COLLECTION SYSTEM WITH STYLUS INPUT
6,254,003	June 18, 1998	OPTICAL READER EXPOSURE CONTROL APPARATUS COMPRISING ILLUMINATION LEVEL DETECTION CIRCUITRY
6,250,551 B1	June 12, 1998	AUTODISCRIMINATING AND LINE DRAWING TECHNIQUES FOR CODE READERS
6,244,512	August 25, 1998	HAND-HELD DATA CAPTURE SYSTEM WITH INTERCHANGEABLE MODULES
6,234,395	March 16, 1995	INSTANT PORTABLE BAR CODE READER
6,223,988 B1	October 14, 1997	HAND-HELD BAR CODE READER WITH LASER SCANNING AND 2D IMAGE CAPTURE
6,223,986 B1	April 16, 1998	AIMING AID FOR OPTICAL DATA READING
6,209,789	November 9, 1999	OPTICAL FILTERING SYSTEM FOR A LASER BAR CODE SCANNER HAVING

		NARROW BAND-PASS CHARACTERISTICS EMPLOYING SPATIALLY SEPARATED FILTERING ELEMENTS INCLUDING A SCANNER WINDOW
6,179,208	November 20, 1998	PORTABLE DATA COLLECTION DEVICE WITH VARIABLE FOCUSING MODULE FOR OPTIC ASSEMBLY
6,177,926	October 22, 1997	HAND-HELD COMPUTER HAVING INPUT SCREEN AND MEANS FOR PREVENTING INADVERTENT ACTUATION OF KEYS
6,173,893	April 16, 1997	FAST FINDING ALGORITHM FOR TWO-DIMENSIONAL SYMBOLOGIES
6,164,544	July 8, 1998	ADJUSTABLE ILLUMINATION SYSTEM FOR A BARCODE SCANNER
6,161,760	September 14, 1998	MULTIPLE APPLICATION MULTITERMINAL DATA COLLECTION NETWORK
6,152,371	August 12, 1998	METHOD AND APPARATUS FOR DECODING BAR CODE SYMBOLS
6,141,046	December 12, 1997	ELELCTRONIC CAMERA HAVING AN ILLUMINATOR WITH DISPERSING RING LENS
6,128,414	September 29, 1997	NON-LINEAR IMAGE PROCESSING AND AUTOMATIC DISCRIMINATING METHOD AND APPARATUS FOR IMAGES SUCH AS IMAGES OF MACHINE-READABLE SYMBOLS
6,123,263	January 29, 1998	HAND HELD DATAFORM READER HAVING STORING ULTRAVIOLET LIGHT ILLUMINATION ASSEMBLY FOR READING FLUORESCENT DATAFORMS
6,123,261	May 5, 1998	OPTICAL SCANNER AND IMAGE READER FOR READING IMAGES AND DECODING OPTICAL INFORMATION INCLUDING ONE AND TWO

		DIMENSINAL SYMBOLOGIES AT VARIABLE DEPTH OF FIELD
6,119,941	May 4, 1998	AUTOMATED HELP INSTRUCTIONS FOR AUTOMATICALLY OR ADAPTIVELY CONFIGURING A HAND-HELD DEVICE, SUCH AS A BAR CODE READER OR HAND-HELD PERSONAL COMPUTER
6,109,528	November 17, 1998	OPTICAL AND PASSIVE ELECTROMAGENTIC READER FOR READING MACHINE-READABLE SYMBOLS, SUCH AS BAR CODES, AND READING WIRELESS TAGS, SUCH AS RADIO FREQUENCY TAGS, AND CORRESPONDING METHOD
6,098,887	September 11, 1998	OPTICAL FOCUSING DEVICE AND METHOD
6,097,839	March 10, 1997	METHOD AND APPARATUS FOR AUTOMATIC DISCRIMINATING AND LOCATING PATTERNS SUCH AS FINDER PATTERNS, OR PORTIONS THEREOF, IN MACHINE READABLE SYMBOLS
6,095,422	August 26, 1999	METHOD AND APPARATUS OF AUTODISCRIMINATING IN SYMBOL READER EMPLOYING PRIORITIZED AND UPDATED TABLE OF SYMBOLOGIES
6,064,763	July 26, 1996	TIME-EFFICIENT METHOD OF ANALYZING IMAGED INPUT DATA TO LOCATE TWO-DIMENSIONAL MACHINE-READABLE SYMBOLS OR OTHER LINEAR IMAGES THEREIN
6,062,475	June 25, 1997	PORTABLE DATA COLLECTION DEVICE INCLUDING COLOR IMAGING DATAFORM READER ASSEMBLY
6,060,722	September 24, 1997	OPTICAL READER HAVING ILLUMINATION ASSEMBLY

		INCLUDING IMPROVED AIMING PATTERN GENERATOR
6,045,047	June 19, 1998	TWO-DIMENSIONAL PART READER HAVING A FOCUSSING GUIDE
6,019,286	February 22, 1996	PORTABLE DATA COLLECTION DEVICE WITH DATAFORM DECODING AND IMAGE CAPTURE CAPABILITY
6,015,088	November 4, 1997	DECODING OF REAL TIME VIDEO IMAGING
5,992,750	July 12, 1994	INSTANT PORTABLE BAR CODE READER
5,992,744	February 18, 1997	OPTICAL READER HAVING MULTIPLE SCANNING ASSEMBLIES WITH SIMULTANEOUSLY DECODED OUTPUTS
5,986,705	February 18, 1997	EXPOSURE CONTROL SYSTEM CONTROLLING A SOLID STATE IMAGE SENSING DEVICE
5,979,763	October 13, 1995	SUB-PIXEL DATAFORM READER WITH DYNAMIC NOISE MARGINS
5,965,863	April 23, 1997	OPTICAL READER SYSTEM COMPRISING LOCAL HOST PROCESSOR AND OPTICAL READER
5,949,057	January 31, 1997	PORTABLE DATA COLLECTION DEVICE WITH CROSSHAIR TARGETING ILLUMINATION ASSEMBLY
5,949,052	October 17, 1997	OBJECT SENSOR SYSTEM FOR STATIONARY POSITION OPTICAL READER
5,942,741	August 19, 1997	APPARATUS FOR OPTIMIZING THROUGHPUT IN DECODED-OUTPUT SCANNERS AND METHOD OF USING SAME
5,932,862	September 3, 1996	OPTICAL READER HAVING IMPROVED SCANNING-DECODING FEATURES

5,929,418	September 3, 1996	OPTICAL READER HAVING IMPROVED MENUING FEATURES
5,920,061	May 29, 1997	PORTABLE DATA COLLECTION DEVICE INCLUDING IMAGING ASSEMBLY WITH MODULAR HIGH DENSITY DATAFORM READER ASSEMBLY
5,914,476	June 22, 1999	OPTICAL READER CONFIGURED TO ACCURATELY AND RAPIDLY READ MULTIPLE SYMBOLS
5,900,613	September 3, 1996	OPTICAL READING HAVING IMPROVED REPROGRAMMING FEATURES
5,841,121	November 19, 1996	HAND-HELD OPTICALLY READABLE CHARACTER SET READER HAVING AUTOMATIC FOCUS CONTROL FOR OPERATINOVER A RANGE OF DISTANCES
5,837,985	July 31, 1996	OPTICAL IMAGING ASSEMBLY HAVING IMPROVED IMAGE SENSOR ORIENTATION
5,834,754	December 12, 1996	PORTABLE DATA COLLECTION DEVICE WITH VIEWING ASSEMBLY
5,831,674	October 4, 1995	OBLIQUE ACCESS TO IMAGE DATA FOR READING BAR CODES
5,831,254	December 18, 1995	EXPOSURE CONTROL APPARATUS FOR USE WITH OPTICAL READERS
5,825,006	September 3, 1996	OPTICAL READER HAVING IMPROVED AUTODISCRIMINATION FEATURES
5,821,518	September 23, 1996	METHOD AND APPARATUS FOR A PORTABLE NON-CONTACT LABEL IMAGER
5,815,200	July 25, 1995	EXTENDED WORKING RANGE DATAFORM READER WITH REDUCED POWER CONSUMPTION

5,811,784	June 26, 1995	EXTENDED WORKING RANGE DATAFORM READER
5,811,774	August 15, 1996	EXTENDED WORKING RANGE DATAFORM READER WITH REDUCED POWER CONSUMPTION
5,793,033	March 29, 1996	PORTABLE DATA COLLECTION DEVICE WITH VIEWING ASSEMBLY
5,786,586	October 28, 1996	HAND-HELD OPTICAL READER HAVING A DETACHABLE LENS-GUIDE ASSEMBLY
5,786,583	February 16, 1996	METHOD AND APPARATUS FOR LOCATING AND DECODING MACHINE-READABLE SYMBOLS
5,786,582	December 8, 1995	OPTICAL SCANNER FOR READING AND DECODING ONE-AND TWO-DIMENSIONAL SYMBOLOGIES AT VARIABLE DEPTHS OF FIELD
5,784,102	February 27, 1997	OPTICAL READER HAVING IMPROVED INTERACTIVE IMAGE SENSING AND CONTROL CIRCUITRY
5,783,811	February 26, 1996	PORTABLE DATA COLLECTION DEVICE WITH LED TARGETING AND ILLUMINATION ASSEMBLY
5,780,834	May 14, 1996	IMAGING AND ILLUMINATION OPTICS ASSEMBLY
5,773,810	March 29, 1996	METHOD FOR GENERATING REAL TIME DEGREE OF FOCUS SIGNAL FOR HANDHELD IMAGING DEVICE
5,773,806	July 20, 1995	METHOD AND APPARATUS FOR CAPTURING A DECODABLE REPRESENTATION OF A 2D BAR CODE SYMBOL USING A HAND-HELD READER HAVING A 1D IMAGE SENSOR
5,756,981	August 1, 1996	OPTICAL SCANNER FOR READING AND DECODING ONE- AND TWO-

		DIMENSIONAL SYMBOLOGIES AT VARIABLE DEPTHS OF FIELD INCLUDING MEMORY EFFICIENT HIGH SPEED IMAGE PROCESSING MEANS AND HIGH ACCURACY IMAGE ANALYSIS MEANS
5,739,518	May 17, 1995	AUTODISCRIMINATION FOR DATAFORM DECODING AND STANDARDIZED RECORDING
5,736,724	May 10, 1995	OBLIQUE ACCESS TO IMAGE DATA FOR READING DATAFORMS
5,719,384	November 29, 1996	OBLIQUE ACCESS TO IMAGE DATA FOR READING DATAFORMS
5,717,195	May 29, 1996	IMAGING BASED SLOT DATA FORM READER
5,659,167	December 6, 1995	VISUALLY INTERACTIVE DECODING OF DATAFORMS
5,646,390	March 25, 1996	DATAFORM READERS AND METHODS
5,623,137	March 30, 1995	ILLUMINATION APPARATUS FOR OPTICAL READERS
5,572,006	July 26, 1994	AUTOMATIC EXPOSURE SINGLE FRAME IMAGING SYSTEMS
5,550,366	June 20, 1994	OPTICAL SCANNER WITH AUTOMATIC ACTIVATION
5,541,419	March 21, 1994	SYMBOLOGY READER WITH REDUCED SPECULAR REFLECTION
5,532,467	September 16, 1994	OPTICAL SCANNING HEAD
5,521,366	October 31, 1994	DATAFORM READERS HAVING CONTROLLED AND OVERLAPPED EXPOSURE INTEGRATION PERIODS
5,463,214	March 4, 1994	APPARATUS FOR OPTIMIZING THROUGHPUT IN DECODED-OUTPUT SCANNERS AND METHOD OF USING THE SAME

5,420,409	October 18, 1993	BAR CODE SCANNER PROVIDING AURAL FEEDBACK
5,418,357	June 16, 1993	BAR-CODE READER PERMITTING SELECTIVE USE OF A WHOLE OR A PART OF AN IMAGE SENSOR
5,410,141	January 7, 1990	HAND-HELD DATA CAPTURE SYSTEM WITH INTERCHANGABLE MODULES
5,378,883	July 19, 1991	OMNIDIRECTIONAL WIDE RANGE HAND HELD BAR CODE READER
5,354,977	October 11, 1994	OPTICAL SCANNING HEAD
5,349,172	October 2, 1992	OPTICAL SCANNING HEAD
5,319,181	March 16, 1992	METHOD AND APPARATUS FOR DECODING TWO-DIMENSIONAL BAR CODE USING CCD/CMD CAMERA
5,304,786	January 5, 1990	HIGH DENSITY TWO-DIMENSIONAL BAR CODE SYMBOL
5,296,689	July 19, 1991	OMNIDIRECTIONAL WIDE RANGE HAND HELD BAR CODE READER
5,288,985	August 31, 1992	INSTANT PORTABLE BAR CODE READER
5,286,960	November 4, 1991	METHOD OF PROGRAMMABLE DIGITIZATION AND BAR CODE SCANNING APPARATUS EMPLOYING SAME
4,471,228	December 2, 1981	SOLID-STATE IMAGE SENSOR WITH EXPOSURE CONTROLLER
4,338,514	April 7, 1980	APPARATUS FOR CONTROLLING EXPOSURE OF A SOLID STATE IMAGE SENSOR ARRAY
RE 36,528	March 24, 1995	OPTICAL SCANNING HEAD
2004/0195328	July 3, 2003	IMAGING MODULE FOR OPTICAL READER

2004/0094627	December 21, 2000	MENU SYMBOL CONTROLLED OPTICAL READER
2004/0004125	December 20, 2002	METHOD AND APPARATUS FOR EXTENDING OPERATING RANGE OF BAR CODE SCANNER
2004/0000592	June 27, 2003	ADJUSTABLE ILLUMINATION SYSTEM FOR A BARCODE SCANNER
2003/0218069	May 20, 2003	INDICIA SENSOR SYSTEM FOR OPTICAL READER
2003/0213847	May 27, 2003	IMAGING MODULE FOR OPTICAL READER COMPRISING REFRACTIVE DIFFUSER
2003/0209603	June 10, 2003	OPTICAL ASSEMBLY FOR BARCODE SCANNER
2003/0197063	May 12, 2003	METHOD FOR PROCESSSING IMAGES CAPTURED WITH BAR CODE READER HAVING AREA IMAGE SENSOR
2003/0085282	December 21, 2000	SCANNING AND DECODING CONTROL FOR AN OPTICAL READER
2003/0062419	July 13, 2001	OPTICAL READER HAVING A COLOR IMAGER
2003/0062418	January 22, 2001	OPTICAL READER HAVING PARTIAL FRAME OPERATING MODE
2002/0191830	July 29, 2002	INDICIA READING DEVICE
2002/0179713	July 22, 2002	EXPOSURE CONTROL METHOD FOR USE WITH OPTICAL READERS
2002/0171745	May 15, 2001	MULTIMODE IMAGE CAPTURING AND DECODING OPTICAL READER
2002/0170970	May 10, 2002	OPTICAL READER HAVING DECODING AND IMAGE CAPTURING FUNCTIONALITY
2002/0096566	February 20, 2002	ADJUSTABLE ILLUMINATION SYSTEM

		FOR A BARCODE SCANNER
2002/0008968	June 18, 2001	IMAGE SENSOR MOUNTING SYSTEM
US D442,152 S	July 17, 2000	MULTIPURPOSE PORTABLE WIRELESS VIDEO APPLIANCE
2002/0150309 A1	April 12, 2002	SYSTEMS AND METHODS FOR PIXEL GAIN COMPENSATION IN MACHINE-READABLE GRAPHICAL CODES

TECHNICAL PUBLICATIONS

Product brochure for the LMC555 CMOS Timer by National Semiconductor Corporation, March 2002, pages 1-10.

Code Reader 2.0 (CR2) – promotional pages, 4/20-21/2004 from www.codecorp.com.

Code Corporation's New Imager Offers Revolutionary Performance and Bluetooth Radio, February 19, 2003, by Benjamin M. Miller, Codex Corporation, 11814 South Election Road, Suite 200, Draper UT 84020.

National Semiconductor's brochure entitled "LM9638 Monochrome CMOS Image Sensor SXGA 18 FPS", 2000, www.national.com.

ABSTRACTS OF DISCLOSURE OF CITED REFERENCES

U.S. Patent No. 6,831,690 B1 to John et al. discloses an electrical sensing device which includes an array of transducer elements for converting external stimuli to electrical indications, including features to realize improvements in low power consumption, low noise, and analog output path which occupies minimal die area while maintaining certain data rates. A two stage pipeline architecture of the invention in the analog output path maintains fast pixel rates with minimal ADC (analog digital converter) arrangement. Also disclosed is a power supply and the use of differential amplifiers in connection with a black signal level as a reference voltage.

U.S. Patent No. 6,736,320 B1 to Crowther et al. discloses a graphical code reader which includes control circuitry for the graphical code reader and a multi-functional optical element in electronic communication with the control circuitry. The multi-functional optical element includes a support structure and a monolithic imaging lens and a target generating mechanism operably connected to the support structure. The imaging lens and target generating mechanism includes a lens and targeting structures for generating converging offset beams to feedback proper target distance. Laser diodes are positioned by the support structure such that the laser light from the diodes is directed through the targeting structures to generate the converging offset beams. An imaging board is connected to the support structure. An imager is mounted to the imaging board and positioned to obtain an image from the lens.

U.S. Patent No. 6,708,883 to Krichever discloses a scanning device for reading indicia of differing light reflectivity, including bar code symbols, has two parallel arrays of light emitters, such as lasers or light emitting diodes, for generating a scanning light beam to visually illuminate sequential portions of the indicia. Two parallel arrays of sensors, such as charge coupled or other solid state imaging devices, detect light reflected from portions of the indicia and generate an electrical signal representative of the spatial intensity variations of portions of the indicia. Each array is arranged transversely of the direction along which the symbol is scanned.

U.S. Patent No. 6,698,656 to Parker et al. discloses an optical reading an optical reading system comprising an optical reader and a host processor. In one aspect of the invention, the host processor may be configured to transmit a component control instruction in response to a command input by a user of the host processor to remotely control the reader. The optical reader subsequently receives the transmitted component control instruction and executes the component control instruction substantially on receipt thereof. In one embodiment, execution of the component control instruction by the optical reader has the same effect as the reader trigger being manually pulled by a reader operator.

U.S. Patent No. 6,695,209 B1 to La et al. discloses an optical reader that includes targeting illuminators which generate a predetermined illumination pattern upon a target. The optical reader captures an image of the target and processes the captured image to determine whether the target is off-pitch or skewed, by analyzing the appearance and characteristics of the predetermined illumination pattern. The illumination pattern may consist of two identical triangles adjacently located but slightly separated so as to cause the pattern to be symmetrical when the target is at perfect alignment, but having shifting characteristics when the target is off-pitch or skewed. The optical reader may use the knowledge of pitch and skew to adjust the captured image. Triggerless operation of the optical reader is provided by placing the optical reader in a cradle and stand having a base with a known target printed on or affixed thereto, within the viewpath of the optical reader. So long as the known target is in the view of the optical reader, it remains in a standby mode, and leaves the standby mode and begins reading when a target is interposed or the optical reader is removed from the cradle. Automatic gain control circuitry is provided having a gain control level which is continuously adjusted when the optical reader is in a standby mode. When the optical reader leaves the standby mode and begins reading, the gain level is pre-adjusted, resulting in a faster level of good data.

U.S. Patent No. 6,685,095 to Roustaei et al. discloses an optical code reading system and method that enhances the ability of a reader to locate a symbol within a field of view and enhances the error-correcting properties of the encoding scheme commonly used in 2D bar codes. The reader offsets the effects of damaged finder patterns and missing symbol perimeters and, thereafter, detects high-level information such as the code type, symbol size, and the number of rows and columns in the symbol. The reader then identifies those missing portions of a damaged symbol and marks each missing data bit location with a predetermined indicator. A decoding algorithm then interprets the missing bit indicator as an error of known location, thereby nearly doubling the error correcting strength of all bar codes employing the Reed-Solomon error correction scheme.

U.S. Patent No. 6,681,994 to Koenck discloses a method and apparatus for optically

reading information. The apparatus includes a photosensor, and a reading system capable of generating a decoded signal regardless of the orientation of the optical indicia relative to the photosensor. The method includes steps of positioning a user-supported optical reader containing photosensor, imaging an information area onto the photosensor without requiring prior angular movement of the reader, and generating a digital representation of content imaged from the information area onto the photosensor for any angular relationship between orthogonal axes of the information area and the pixel axes of the photosensor.

U.S. Patent No. 6,669,093 B1 to Meyerson et al. discloses a portable data collection device having a modular imaging-based dataform reader. The dataform reader is adapted to independently read first and second overlying dataforms, the first dataform is imaged and decoded when illuminated by radiation having first wavelength and the second dataform is imaged and decoded when illuminated by radiation having a second wavelength. Control and selection circuitry is electrically coupled to an imaging assembly and an illumination assembly to actuate the imaging assembly and selectively energize a first illumination source which generates radiation having a first range of wavelengths to image and decode the first dataform while a second illumination source is deenergized and to actuate the imaging assembly and selectively energize the second illumination source which generates radiation having a second range of wavelengths to image and decode the second dataform while the first illumination source is deenergized.

U.S. Patent No. 6,637,658 to Barber et al. discloses an optical reader having a 2D image sensor that is configured to operate in a partial frame capture mode. In a partial frame operating mode, the reader clocks out and captures at least one partial frame of image data having image data corresponding to less than all of the pixels of an image sensor pixel array. In one embodiment, the reader operating in a partial frame operating mode captures image data corresponding to a linear pattern of pixels of the image sensor, reads the image data, attempts to decode for a decodable 1D symbol which may be represented in the image data, and captures a full frame of image data if the image data reading reveals a 2D symbol is likely to be present in a full field of view of the 2D image sensor.

U.S. Patent No. 6,619,547 B2 to Crowther et al. discloses a graphical code reader which includes control circuitry for the graphical code reader and a multi-functional optical element in electronic communication with the control circuitry. The multi-functional optical element includes a support structure and a monolithic imaging lens and target generating mechanism operably connected to the support structure. The imaging lens and target generating mechanism includes a lens and targeting structures for generating converging offset beams to feedback proper target distance. Laser diodes are positioned by the support structure such that laser light from the diodes is directed through the targeting structures to generate the converging offset beams. An imaging board is connected to the support structure. An imager is mounted to the imaging board and positioned to obtain an image from the lens.

U.S. Patent No. 6,565,003 to Ma discloses a method for locating and reading a two-dimensional barcode wherein two-dimensional barcodes surrounded by a quiet zone of white space which may or may not include a border, each barcode having encoded digital information in a bitmap representing preferably randomized encoded data bits, are printed onto a printed medium. To extract the encoded digital information from the printed medium, the printed medium is

scanned, then the bitmap is located within the printed medium by moving a window, in stepwise fashion in a predetermined pattern across the printed medium. At each step the portion of the printed medium which is encompassed by the window is tested to determine whether it conforms to one or more characteristics of the bitmap. The skew of the bitmap, if any, is determined, by using a finite-state recognizer in combination with a Hough Transform calculation. In one embodiment, the candidate region is divided into a plurality of horizontal regions, preliminary skew angles are calculated for each region, and the actual skew angle is selected using a voting scheme. Once the skew angle is calculated, the bitmap is deskewed if necessary, cropped, and the randomized digital information is read from the bitmap. Finally, the digital information is derandomized and any error correction codes are removed, in the process correcting and/or recording any errors discovered, thereby reproducing the original encoded digital information.

U.S. Patent No. 6,550,679 to Hennick et al. discloses a multilayered image sensor which is back mounted to a plate, and the plate in turn, is installed in a holding pocket of a device. In that the scheme takes advantage of a high controllability of a mounting plate's thickness, the mounting scheme provides a tight control of holding forces with which an image sensor is secured in an imaging device. In that the scheme provides for back mounting of image sensor on a planar surface, the mounting system provides tight control of an imaging assembly's pixel plane to fixed point in space distance.

U.S. Patent No. 6,547,139 to Havens et al. discloses a method and apparatus wherein the operating depth of field for a bar code scanner, preferably a laser scanner, is increased by placing a cubic phase mask (CPM) in the scanning beam. The masked beam is then scanned and reflected off a bar code and received by a photodetector. The received signal is then processed to recover the original unperturbed representation of the bar code pattern. The processed signal has an increased depth of field over an unmasked scanner signal.

U.S. Patent No. 6,527,182 B1 to Chiba et al. discloses an image reading apparatus comprising an image reading section which optically reads one line of an image on a paper at a specific time interval and inputs the acquired image data to an image signal processing section which converts the image data into a binary image data. An amount of movement detection section is provided which outputs a signal to an image data generation section when the image reading section moves by one line. When such a signal is received more than one time during one time interval, the image data generation section generates a binary image data corresponding to the number of lines whose data is not available from the binary image data for a line acquired during that time interval.

U.S Patent No. 6,497,368 to Friend et al. discloses a portable data collection system employing a portable data terminal having increased functionality. The portable data terminal includes an integral magnetic stripe reader for reading information magnetically encoded on a magnetic stripe card, such as a credit card or the like. An interchangeable feature pod may be attachable to the data terminal and may include a selected data collection or communication device such as, for example, a data communication port, optical indicia reader or laser scanner to facilitate data entry and communication. The interchangeable feature pod may include a compact, ergonomically efficient actuator for activating the selected data collection or communication device. Interconnection of the portable data terminal to interchangeable feature apparatus such as

an electrical power supply, peripheral devices, or data communication apparatus may be accomplished via separate line connection, a port replication apparatus or a vehicle docking apparatus.

U.S. Patent No. 6,491,223 to Longacre, Jr. et al. discloses a method and apparatus for autodiscriminating and decoding any of a plurality of 1D linear bar code symbols which use different 1D symbologies and of 2D matrix bar code symbols which use different 2D finder patterns and 2D symbologies. A processor stores a plurality of 1D decoding programs, a plurality of 2D decoding programs, and a parameter table that specifies which of said programs are to be enabled. During 1D autodiscriminating, the processor makes not attempt to decode unknown symbols in accordance with 1D decoding programs that are not enabled. During 2D autodiscrimination, the processor makes not attempt to decode unknown 2D symbols in accordance with 2D decoding programs that are not enabled.

U.S. Patent No. 6,489,798 B1 to Scott-Thomas et al. discloses a method and apparatus for testing an image sensor array such as a C-MOS imager which has sensing circuits arranged in rows and columns and wherein the sensing circuits include photosensitive devices. A reset voltage is applied to the photosensitive device in each of the sensor circuits such that at least adjacent circuits are reset to different voltage levels. The voltage on each photosensitive device is detected and compared to an expected level to determine if and where any faults may exist in the sensing circuits or lines in the array. A different reset voltage may be applied to each of the sensor circuits, however, in one embodiment, a supply with only two voltage levels may be used. One voltage level is applied to every second column to provide a supply voltage to the photosensitive devices and to every second row to generate a reset enable signal for the photosensitive devices. The second voltage level is applied to the remaining columns and rows resulting in different reset voltage levels on adjacent sensing circuits.

U.S Patent No. 6,478,223 to Ackley discloses a color symbology, such as a bar code symbology, which employs three or more colors to encode elements of one or more integer-widths. A light source or an appropriate filter of a color matched to one color of the symbology produces peaks in a reflectance signal produced from a light sensor, which receives light reflected from the symbol. Another, unmatched, color in the symbology produces valleys in the reflectance profile. A third or intermediate color produces a reflectance signal in a middle portion of the reflectance profile. By identifying the peaks and valleys in the profile, the portions corresponding to the intermediate color, may be found by measuring distances between centers of the peaks and valleys in the reflectance profile. As a result, all elements, of all colors in the symbol, may be decoded using a simple data collection reader, such as a laser scanner, employing only a single color laser.

U.S. Patent No. 6,469,289 B1 to Scott-Thomas et al. discloses a method and apparatus for determining the level of ambient light impinging on a selected number of pixels in an imaging array where each pixel includes a photodiode. The ambient light may be determined by resetting the pixels in the array and by detecting current flow through the photodiodes in a selected number of the pixels as they are being reset. Alternately, the ambient light may be determined by resetting a selected number of the pixels in the array and by detecting current flow through the photodiodes

in the selected number of the pixels as they are being reset. The photodiodes are reset by applying a reverse bias voltage across them and the current flow is detected by measuring the current flow through a resistance parallel to the selected photodiodes. The selected number of pixels may be divided into one or more groups each having at least one pixel, and the pixels in each group may be arranged in specific patterns within the array. The array may be laid out in rows and columns, and the groups may be located in predetermined rows or columns. When only a selected number of pixels are reset and these pixels are divided into groups, the groups may be sequentially reset to permit differentiation between the groups.

U.S Patent No. 6,435,411 to Massieu et al. discloses an optoelectronic device for acquisition of images of objects, such as barcodes, which includes a lighting system that is designed such that the axis of the light beam intersects the optical axis. A reflector that allows the image beam to pass through, and can reflect the light beam, is disposed such as to intercept the light beam, and is inclined relative to the optical axis, by an angle which is such that the light beam is centered on the optical axis. The lighting system is designed to light the useful optical field throughout the entire depth of the field, and the angle _, in which the lighting system is seen from the object plane, is such that L is the width of the object plane, and P is the distance between the object and the lighting system.

U.S. Patent No. 6,431,452 to Feng discloses a portable data collection device wherein an imaging assembly includes a two dimensional (2D) photosensor array. The imaging assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a image of the target object in the target area. The device also includes an illumination assembly including an circuit board assembly supporting illumination and targeting light emitting diodes and a lens array or panel positioned adjacent the circuit board assembly for focusing an even pattern of illumination on the target area and generating a crosshair illumination pattern for aiming the device at the target dataform. The device further includes an optic assembly for focusing reflected illumination from the target area onto the two dimensional photosensor array. The optic assembly includes a focusing optic for changing a best focus distance of the optic assembly as a function of moving a wedge shaped optic with respect to a stationary optic to change a thickness of the focusing optic.

U.S. Patent No. 6,398,112 B1 to Li et al. discloses a scanning device for reading indicia of differing light reflectivity, which includes bar code or matrix array symbols, and has a single light emitter, such as a laser or light emitting diode, for generating a scanning light beam to visually illuminate sequential portions of the indicia. A sensor, such as a charge coupled or other solid state imaging device, simultaneously detects light reflected from portions of the indicia and generates an electrical signal representative of the special intensity variations in the portions of the indicia. The scanning device may also include an ambient light sensor, and a second light emitter for use only in aiming or orienting the scanning device. A photodetector may also be provided to separately detect one symbol virtually simultaneous with the detection of another symbol by the sensor or to provide dual modalities. A method for reading indicia is also provided.

U.S. Patent No. 6,390,625 to Slawson et al. discloses a focusing mechanism for an optical instrument that includes an eyepiece having at least one lens element retained within an eyepiece housing, a stationary carrier for retaining the eyepiece, and a rotatable thumb wheel. A pair of levers operatively connect the eyepiece housing with the rotatable thumb wheel, the thumb wheel including corresponding pairs of cam channels on either side for receiving one end of a corresponding lever, the remaining end of each lever engaging the eyepiece housing, wherein rotational movement of the thumb wheel produces axial movement of the eyepiece relative to said carrier.

U.S. Patent No. 6,385,352 B1 to Roustaei discloses a system and method for reading a two-dimensional image, and for comparing the two-dimensional image to stored data representative of a known image. The optical scanning device comprises a sensor for capturing the two-dimensional image, which sensor includes an LED array for projecting an emitted light towards the two-dimensional image. The sensor also includes a lens disposed forward of the LED array for focusing the emitted light and thereby framing the two-dimensional image. The sensor further includes an optical assembly for focusing an ambient light reflected from the framed two-dimensional image. And the sensor includes a CMOS or CCD detector for detecting the focused ambient light, the CMOS detector including a photodiode array for sensing the focused ambient light and a processor for processing the ambient light to obtain an electrical image signal. The optical scanning device also compresses the electrical image signal. Finally, the optical scanning device decodes the compressed image signal. Finally, the optical scanning device decodes the compressed image signal to obtain image data representative of the two-dimensional image. The image data can be compared to the stored data to determine if the two-dimensional image matches the known image.

U.S. Patent No. 6,371,374 to Schwartz et al. discloses an apparatus for adjusting the position of a line of light in barcode space that includes a support frame having a rear housing containing a solid state imager and a pair of support arms extending forwardly from the front of the housing. An imaging lens is mounted between the arms for focusing an image of a target in barcode space upon the solid state imager along the optical axis of the imaging lens. Illuminating LEDs are mounted on either side of the imaging lens for illuminating the target. The illumination is passed through a pair of cylindrical lenses that are adjustably mounted upon the distal ends of the arm so that the light can be selectively positioned in barcode space.

U.S. Patent No. 6,367,699 to Ackley discloses an apparatus and method for imaging low contrast one and two-dimensional symbols. A light source directs light onto a target that includes a low contrast symbol. An imaging element receives light reflected off of the target and creates an image of the target therefrom. A light level detector determines the intensity level of the light received by the imaging element, and when the intensity level exceeds a predetermined threshold, a controller causes the image data created by the imaging element to be stored in a data memory. In an embodiment of the invention, a light wand is provided with the light source and imaging element. The light wand is adapted to read low contrast bar code symbols disposed on a substrate material using specular light reflected from the bar code symbols by maintaining the light wand at an optimum angle with respect to the substrate material. An alignment tip may further be utilized with the light wand to ensure that the light wand is maintained at the optimum angle.

U.S. Patent No. 6,347,163 B2 to Roustaei discloses a system for reading a two-dimensional image, and for comparing the two-dimensional image to stored data representative of a known image. The optical scanning device comprises a sensor for capturing the two-dimensional image, which sensor includes a light source for projecting an emitted light towards the two-dimensional image and an optical assembly for focusing light, which may be ambient and or emitted light from the light source, reflected from the framed two-dimensional image onto a CMOS or CCD detector for detecting the focused light, the detector including a photodiode array for sensing the focused light and generating a signal therefrom. Aiming of the sensor to read the two-dimensional image is facilitated by a frame locator consisting of a laser diode which emits a beam that is modified by optics, including diffractive optics, to divide the beam into beamlets which have a spacing therebetween that expands to match the dimensions of the field of view of the sensor, forming points of light at the target to define the edges of the field of view.

U.S. Patent No. 6,345,765 to Wiklof discloses an optical system, such as a bar code scanner, which illuminates an image with a multi-wavelength device. Under a first embodiment, a tunable laser is optically coupled with a prism or other wavelength separation device. As the laser beam wavelength varies, the transmission path through the prism changes, resulting in a scanning of the beam across an image. A photodetector captures light reflected from the image and sends it to a microprocessor for decoding. Under another embodiment, a broad band light source transmits light through a prism, thus shining a "rainbow" on the image. A spectrometer measures reflected light as a function of wavelength and sends the resultant signal to a microprocessor for decoding. Neither embodiment relies on moving parts to scan the image.

U.S. Patent No. 6,340,114 B1 to Correa et al. discloses an imaging engine and signal processing devices and methods for reading various kinds of optical codes. The compact structure may include a two dimensional image sensor, apparatus for focusing images at different focal disclosures, an aiming system, a hi-low beam illumination system and related signal processing circuits.

U.S. Patent No. 6,336,587 B1 to He et al. discloses an imaging optical code reader adapted for use in producing video displays and for use in motion detection surveillance using video compression and narrow band width communication links. An optical system including a plane parallel plate may be employed to change the system focal distance. The imaging optical code reader is also adapted for measurement of physical parameters of a target object including motion, distance, weight and dimensions.

U.S Patent No. 6,330,974 to Ackley discloses an apparatus that permits high resolution imaging of low contrast one and two-dimensional symbols and which includes a housing having a window and an electro-optical element disposed within the housing behind the window. At least two laser diodes are mounted externally to the housing adjacent to the window. The laser diodes respectively provide beams that intersect at a point within a field of view of the electro-optical element, and the beams provide light to the electro-optical element through the window that has

reflected off a symbol positioned at the intersection point. The laser diodes may be selectively or automatically triggered upon the symbol being positioned at the intersection point.

U.S Patent No. 6,298,176 to Longacre, Jr. et al. discloses a system for imaging a scene comprising an optical reader and a specially structured symbol configured complementarily with the reader so that when the reader reads the symbol, the reader reads image data in an image data reading region. The image reading instruction symbol of the system may include indicators for controlling various aspects of the image reading process such as the dimension of the image capture region, the relative position of the image reading region. If the image reading instruction symbol is of a type whose actual size, orientation, and distortion can be determined, scaling, orientation, and distortion characteristics determined from the image reading instruction symbol can be used to improve the image reading process. A feedback feature may be included in the reader for indicating to a user whether the reader should be moved in order to improve image reading.

U.S. Patent No. 6,298,175 to Longacre, Jr. et al. discloses a system for sensing the presence of an object in the field of view of an imaging assembly of a stationary position optical reader. The system includes a light source disposed in a field of view of the imaging assembly, which is configured to emit light in the direction of the imaging assembly according to a predetermined light pattern. A determination as to whether an object is present in a presentation area of the reader system is made by detecting for the presence of the light pattern in image information generated by the imaging assembly.

U.S. Patent No. 6,275,388 to Hennick et al. discloses a system wherein a multilayered image sensor is backmounted to a plate, and the plate in turn, is installed in a holding pocket of a device. The mounting scheme takes advantage of a high controllability of a mounting plate's thickness and provides for tight control of holding forces with which an image sensor is secured in an imaging device. The scheme provides for back mounting of image sensor on a planar surface, the mounting system provides tight control of an imaging assembly's pixel plane to fixed point in space distance.

U.S. Patent No. 6,266,685 to Danielson et al. discloses a hand-held data input system having an input stylus and a data receiving pad. The data input system can include a recessed stylus holder. The recessed stylus holder can receive the input stylus such that it does not protrude from the system's housing. The data input system can alternatively include a grip facilitator. The grip facilitator can be located proximate the data receiving pad to make contact with a finger of a hand gripping a side of the hand-held unit. Other embodiments include features such as an active stylus, a radio frequency receiver, input keys, handwriting recognition capability, an indicia reader and a handstrap.

U.S. Patent No. 6,254,003 to Pettinelli et al. discloses an exposure control apparatus for use with optical readers, such as bar code readers, which utilize photosensitive image sensors. An illumination signal generating circuit generates an illumination signal having a magnitude that

varies in accordance with the illumination level at the image sensor. A window detecting circuit samples the illumination signal during a predetermined part of each scan to determine whether the illumination signal is within the window, has exited the window, or has re-entered the window. Exposure control circuitry uses the output of the window detecting circuit to control which of a plurality of the subdivisions of the exposure control range of the image sensor will be used. Changes in exposure time are made only between adjacent subdivisions of the exposure control range. Together with a predetermined hysteresis between the exit and re-entry thresholds of the window, the latter changes stabilize the operation of the reader by reducing exposure control "hunting".

U.S. Patent No. 6,250,551 B1 to He et al. discloses optical image readers having a two-dimensional image sensor and an auto-discrimination function. The auto-discrimination function identifies optical codes by type for pixel clusters and, in some cases, tilt angle and start/stop coordinates. The clustered pixel data is passed to an appropriate decoder identified by the auto-discrimination function based upon a likelihood that the cluster contains an optical code of a particular type. Line drawing techniques provide for adequate sampling of the clustered pixel data code based on the tilt angle of the code relative to an image sensor array.

U.S. Patent No. 6,244,512 to Koenck et al. discloses a hand-held data collection device with a user interface surface that is wider than its handgrip area and also, a hand-held data collection device with an upwardly facing surface containing a user interface and a side surface containing a plurality of actuators. The data collection device can be held in one hand with a finger reaching the actuators. An opposite side surface can also contain a plurality of actuators. The data collection device can include combinations of a marker beam generator, an indicia reader, a display, a manually actuatable selector, a voice input and a digitizer. The indicia reader can be an optical reader or a radio frequency tag reader. Some of the actuators can have different shapes. The actuators can include an indicia reader actuator or a function selector. The data collection device can collect, for example, handwritten information, including signatures.

U.S Patent No. 6,234,395 to Chadima et al. discloses a hand held bar code reader which has a handle portion and a reader head portion which may be held spaced from a bar code data carrier during a reading operation. Light energy is directed outwardly through a window so as to illuminate a bar code sensing region in front of the window having a depth dimension of at least about ten millimeters, and an optical system focuses bar code patterns in the sensing region onto an image photosensor in the reader unit with a resolution so as to read e.g. bar code formats with a minimum bar or space width of about 0.0075 inch or less. The bar code image is converged through a generally rectangular optical aperture and is reflected onto the image photosensor by a reflecting mirror positioned relative to the image photosensor by virtue of their common association with a printed circuit board.

U.S. Patent No. 6,223,988 B1 to Batterman discloses a hand-held bar code reader which includes a laser scanning module and a two dimensional image sensor and processing for reading a bar code. The laser scanner assists the 2D image processing by providing information on location, type, range, reflectivity, and presence of bar code for 2D reading. Additionally, the 2D imaging

reading operation is improved by using the laser scan as a spotter beam for aiming.

U.S. Patent No. 6,223,986 B1 to Bobba et al. discloses data reading systems including an aiming aid system that creates a highly visible target or image in the scan volume at a preferred location for placement of the article to be scanned. In a preferred application, an overhead bar code scanner employs a rotating polygon mirror which scans one or more laser beams of pattern mirrors creating a complex pattern of scan lines down into the scan volume whereby the aiming aid is created by directing a laser beam onto a scanning mirror positioned on top of the polygon mirror generally along the rotational axis of the polygon mirror and then directing that beam out into the scan volume in the desired pattern, such as a circular aiming aid. Alternately, the aiming aid may be a multi-dimensional graphical image formed by holographic or diffractive optics.

U.S. Patent No. 6,209,789 to Amundsen et al. discloses a optical filtering system for a laser bar code scanner having narrow band-pass characteristics. The optical filtering system has two different optical filtering elements which are disposed in a scanner housing in a spatially separate relationship. One of the optical filtering elements is positioned inside of the scanner housing in front of and close to the light detection element. The other optical filtering element is positioned in the light transmission aperture of the scanner housing and forms the scanning window. The optical filtering characteristics of the scanning window obscure the internal components of the scanner from plain view making the scanner appear more aesthetically pleasing. Together the optical filtering element cooperate to form a narrow-band pass filter to provide for better light collection and scanning.

U.S. Patent No. 6,179,208 to Feng discloses a portable data collection device which includes an imaging assembly and a two dimensional (2D) photosensor array. The imaging assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a image of the target object in the target area. The device also includes an illumination assembly including an circuit board assembly supporting illumination and targeting light emitting diodes and a lens array or panel positioned adjacent the circuit board assembly for focusing an even pattern of illumination on the target area and generating a crosshair illumination pattern for aiming the device at the target dataform. The device further includes an optic assembly for focusing reflected illumination from the target area onto the two dimensional photosensor array. The optic assembly includes a focusing optic for changing a best focus distance of the optic assembly as a function of moving a wedge shaped optic with respect to a stationary optic to change a thickness of the focusing optic.

U.S Patent No. 6,177,926 to Kunert discloses a hand-held computer terminal employing a touch screen for the input of handwritten data which comprises a contoured surface disposed between a touch screen surface and input keys or buttons, thereby providing improved ergonomics aiding in the entry of handwritten data while preventing unintentional actuation of input keys or button during the entry of handwritten data.

U.S Patent No. 6,173,893 to Maltsev et al. discloses a fast finding algorithm wherein a plurality of scan lines is used to detect characteristic features of a checkerboard structure or similar pattern structure of symbology within a field of view. The scan lines cross leading edges of the

symbology which provides signals to a plurality of processors. The processors detect instances wherein sequential leading edges exhibit angular shifts corresponding to a pattern of the symbology. A further processor is used to detect when a coincidence of these angular shifts occur, thereby providing an indication of the location of the symbology within the field of view.

U.S. Patent No. 6,164,544 to Schwartz et al. discloses an apparatus for adjusting the position of a line of light in barcode space that includes a support frame having a rear housing containing a solid state imager and a pair of support arms extending forwardly from the front of the housing. An imaging lens is mounted between the arms for focusing an image of a target in barcode space upon the solid state imager along the optical axis of the imaging lens. Illuminating LEDs are mounted on either side of the imaging lens for illuminating the target. The illumination is passed through a pair of cylindrical lenses that are adjustably mounted upon the distal ends of the arm so that the light can be selectively positioned in barcode space.

U.S. Patent No. 6,161,760 to Marrs et al. discloses a multiterminal data collection network which includes a plurality of terminals and a base station configured so that each data collection terminal can be programmed in accordance with one of a predetermined number of available application. When a data collection terminal such as a bar code reader is programmed to operate in accordance with a particular application, the reader operates according to a data collection protocol that is the same as the data collection protocol of each other reader in the network programmed to operate in accordance with that same application. In another aspect of the invention, a base station normally transmits messages received from different readers according to different transmission protocols if the readers are programmed to operate in accordance with different applications, and transmits messages received from different readers according to the same protocol if the readers are programmed in accordance with the same application. A reader of the network can be associated with a new application group by reading of a specially designed application selector symbol.

U.S. Patent No. 6,152,371 to Schwartz et al. discloses a method and apparatus for reading and decoding one-dimensional (1D) bar code symbols. A 1D bar code symbol is imaged by an optical assembly which includes a cubic phase mask that causes the optical transfer function of the optical assembly to remain approximately constant over a range of distances between the apparatus and the symbol to be read. An electrical representation of the resulting image is converted to a smoothly varying analog image signal. A transition identifying circuit processes the analog image signal, without first applying a recovery function that takes into account the effect of the phase mask, and generates a binary signal which is used to decode the symbol.

U.S. Patent No. 6,141,046 to Roth et al. discloses a hand held label reader capable of illuminating a label, capturing a digital image of two-dimensional information indicia on the label, and decoding the digital image to provide decoded output data to a terminal. The target label is illuminated by a low variation illuminator that includes a circular LED array mounted behind a plano-concave dispersing lens. The automatic electronic camera, which includes a CCD camera and control circuitry, uses three images to adjust the intensity of the digital image and store a

properly exposed image of the label in video RAM. The intensity of the digital image is adjusted by controlling the video system gain via adjusting the CCD array's integration time, the gain of a video amplifier, and the gain provided by an analog-to-digital converter. The gain provided by the analog-digital-converter is adjusted to compensate for the attenuation of light through the camera's lens assembly. For the first image, the digital image is obtained using a default setting for the gain. The image intensity is analyzed using a histogram process and new gain setting are determined. The second image is obtained using the gain settings derived from the first image. The second image intensity is analyzed and the gain settings are adjusted. These settings are used for the third video image. The digital image from the third image is stored in video RAM, where it is available to be decoded by a microprocessor.

U.S Patent No. 6,128,414 to Liu discloses a method and apparatus for locating geometric shapes or edges thereof in data collection symbols initially samples and stores an image of light reflected from the symbol. Thereafter, two routines are performed. A first routine performs low level vision processing by identifying linked points along edges, lines, curves or within shapes. At least one of three distortion compensating subroutines compensate for blocking, breaking, gaps or other severe distortions affecting shapes in the stored image. Under a first subroutine, an edge of a shape is tracked until a stopping condition occurs, at which point the shape is crossed so as to continue tracking on an opposite edge. Under a second subroutine, previously collected linear curve information is used to identify a jump point to continue tracking following a stopping condition. Under a third subroutine, mathematical morphology techniques are employed to close gaps or move blockage in shapes in the stored image. Coordinates of linked points, which represent lines, curves and other geometric shapes, from the first routine are then employed by a second routine which identifies patterns within the identified lines/curves. Based on these identified patterns, types of symbols from various symbologies can be identified and located within the stored image.

U.S. Patent No. 6,123,263 to Feng discloses a portable data collection device having a modular imaging-based dataform reader. The dataform reader includes a two dimensional imaging assembly adapted to image and decode a dataform printed using ink that fluoresces when illuminated by ultraviolet light. The imaging assembly includes a two dimensional photosensor array and is actuatable to generate a signal representative of reflected illumination from a target area of the imaging assembly and further includes an illumination assembly having a strobing ultraviolet light source. The illumination assembly includes a pair of flash tube strobe lights which have their output illumination filtered through respective ultraviolet filter thereby permitting only illumination in the ultraviolet range to exit the dataform reader and illuminate the imaging target area. The high intensity, strobing light of the ultraviolet light source permits a reduced exposure period. A targeting illumination assembly is also provided to aid in aiming the device at a target dataform. The targeting illumination assembly and illumination assembly are alternately energized to reduce reflected glare. Fluorescence from the dataform is focused by an optic assembly onto the photosensor array forming an image of the dataform. Image processing circuitry is provided for processing and decoding the image of the dataform.

U.S. Patent No. 6,123,261 to Roustaei discloses an integrated system and method for reading image data. An optical scanner/image reader is provided for reading images and decoding optical information or code, including one and two dimensional symbologies at variable depths of

field including memory and image processing for high speed applications.

U.S Patent No. 6,119,941 to Katsandres et al. discloses a method and system for guiding a hand-held device operator through the process of enabling input and output devices on the hand-held device. In one exemplary embodiment of the invention, a hand-held device includes a bar code reader which images or scans a bar code label. The hand-held device then searches its enabled bar code symbologies for a bar code symbology which interprets the scanned bar code label. If the device cannot interpret the scanned bar code label according to its presently enabled bar code symbologies, the device then examines its non-enabled bar code symbologies. If the scanned bar code label can be interpreted according to a non-enabled bar code symbology, then the device queries the operator to determine if the bar code symbology should be enabled. If the operator requests enablement of the bar code symbology, then the device changes the bar code symbology to an enabled status and interprets the scanned bar code label according to the newly enabled bar code symbology. Otherwise, the device generates an error message and sends it to the operator. Other embodiments of the invention permit the enablement of input devices such as touch-sensitive screens, keyboards, and operator-selectable input buttons.

U.S Patent No. 6,109,528 to Ohanian et al. discloses a portable hand-held data terminal having a curvilinear cross-sectional keypad capable of operation by one hand. In an exemplary embodiment of the invention the keys may extend to various heights above the keypad depending on their function. For example, a scan trigger key may extend the farthest from the terminal, numeric keys may extend the next farthest, and alphabetic keys may extend the least. The data terminal may also provide a quick release pistol grip to terminal attachment which utilizes, in an exemplary embodiment, a pair of removably receivable compressible O-rings, a pair of removably receivable guides, and a lever-type latch mechanism. The invention may also provide an interface between the pistol grip assembly's trigger mechanism and the data terminal which does not require that the housing of the data terminal be pierced. In an exemplary embodiment this interface utilizes a reed switch, mounted inside the data terminal's housing, and a magnetic trigger assembly wherein the reed switch is held closed by the magnet when the trigger is depressed.

U.S. Patent No. 6,098,887 to Figarella et al. discloses a hand held omnidirectional symbology or bar code reader for imaging linear and two dimensional bar codes over relatively long working distances. The reader includes an imaging system including a focusing objective taking lens and a two-dimensional photodetector that operate to form an image of a bar code in 2 directions simultaneously and generate an electrical signal representative of the code for subsequent downstream processing which extracts information embedded in a bar code. Focusing is achieved via a rotating disk that carries a plurality of opti9cal shims for different focus zones. A through-the-lens targeting system is provided to visually assist the user in positioning the reader for a variety of code modalities to assure that a bar code will be captured within the field of view and be sharply imaged on the photodetector when the lens is focused. Two different forms of artificial illumination are provided to accommodate nearby codes that may be either specular or partially diffuse and more distant codes where the reflection characteristics have less impact on code contrast. Elements of the photodetector are used to assess available light levels and activate the artificial illumination system when ambient light levels are low. Ranging through the lens using elements of the photodetector is included to provide information to set the focus of the

objective lens in one of many possible focusing zones. All of the reader's components are housed in an ergonomically designed shell to reduce user repetitive stress injuries while providing access to a user interface and a protective cover for the reader's various systems.

U.S Patent No. 6,097,839 to Liu discloses a method and apparatus for locating geometric shapes or edges thereof in data collection symbols initially samples and stores an image of light reflected from the symbol. Thereafter, two routines are performed. A first routine performs low level vision processing by identifying linked points along edges, lines, curves or within shapes. A rapid pixel linking subroutine identifies edge pixels in symbol images lacking distortion. If the edge or shape suffers from distortions, then one or more distortion compensating subroutines locate sequential linked pixels despite such distortions. The resulting coordinates of linked points, which represent lines, curves and other geometric shapes, are then employed by a second routine which identifies patterns within the identified lines/curves. Based on these identified patterns, types of symbols from various symbologies can be identified and located within the stored image.

U.S. Patent No. 6,095,422 to Ogami discloses a method and apparatus for employing a weighted order stored in a weight table for automatically discriminating optical symbols which may be encoded in any one of at least two symbologies. The weighted order may be dynamically updated to reflect the distribution of symbologies as the symbols are acquired and decoded.

U.S. Patent No. 6,064,763 to Maltsev discloses a method and apparatus for locating edges of patterns in a stored image, such as edges of start/stop patterns of machine-readable symbols (e.g., PDF 417 symbols). The stored image is divided into analysis regions and samples each region using a 16-beam star pattern. The beam patterns are analyzed to detect for edges that may correspond to edges of start/stop patterns of the symbol. Coast lines, or elongated edges, of the detected edges are analyzed for parallelism and minimal length to filter out any spurious detected edges. Thereafter, the coast lines are analyzed to confirm that a start or stop pattern has been located. A second start/stop pattern is thereafter located, boundary points are determined at a periphery of the symbol, and finally the symbol is analyzed for its geometric shape to confirm that the located boundary points conform to an accepted geometry for this symbol.

U.S. Patent No. 6,062,475 to Feng discloses a portable data collection device which provides for dataform decoding and color imaging. An imaging assembly is provided that includes a board camera having black and white circuitry and generates a composite video signal representing an image of a target area of the imaging assembly when actuated. The imaging assembly includes a two dimensional photosensor array overlaid by a color filter having a repeating pattern of four color filter elements. The imaging assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a image of the target object in the target area. When the device is operated in the dataform reading mode, compensation circuitry is actuated to operate on digital gray scale values extracted from the composite video signal to adjust gray scale value magnitudes to compensate for the transmittivity differences of the color filter elements to improve decodability of the imaged dataform. When the device is operated in the imaging mode,

conversion circuitry is actuated to convert the gray scale values to either Y-C or RGB digital data and a D/A converter further processes the Y-C or RGB digital data to provide an analog Y-C or RGB output signal.

U.S. Patent No. 6,060,722 to Havens et al. discloses an optical assembly for use with optoelectronic readers. An imaging optical assembly having an imaging optical axis forms an image of a two-dimensional region on an opto-electronic imaging device. An aiming pattern generator including at least a point-hike aiming light source and an interferometric pattern generating optical element project onto the two-dimensional region a luminous aiming pattern that approximately coincides with the field of view of the imaging device. The aiming optical axis of the aiming pattern remains approximately coincident with the field of view of the imaging device over the range of reader-to-target distances over which the reader is used.

U.S. Patent No. 6,045,047 to Pidhirny et al. discloses an optical reader suitable for reading 2-dimensional indicis. The optical reading device, that may include a bar code reader, comprises a guide whose length along the optical reader optical axis is such that when that guide contacts the part or equipment surrounding the indicia to be read, that indicia is within the optical reader depth of field. The reader comprises a housing having therein a source of illumination and optics for producing a diverging beam for illuminating indica. A spacing element transparent guide is removably attached to the housing, and does not block indica. The line of contact of the guide with the data carrier is substantially fully visible to the operator, who can thus confirm that the guide is in proper operating position relative to the indica prior to initiating a reading operation. A reading operation can be initiated by pressing on the guide to actuate a switch, or on a manual trigger.

U.S. Patent No. 6,019,286 to Li et al. discloses a portable data collection device wherein an imaging assembly includes a two dimensional (2D) photosensor array overlied by a RGB color filter. The imaging assembly is selectively actuatable with a first trigger for reading a dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a color image of the target area. In one operating embodiment of the portable data collection device of the present invention, actuating the first trigger results in the imaging assembly capturing an image of the target area including a dataform and an associated image area of interest. The image area of interest is at a predetermined position with respect to the dataform. The imaging assembly decodes the dataform and outputs a compressed, digital representation of the image area of interest along with decoded data from the dataform. The position of the image area of interest is determined by a position of the dataform in the target area and data relating to the predetermined position of the image area of interest with respect to the dataform.

U.S. Patent No. 6,015,088 to Parker et al. discloses a process for allowing an image capturing apparatus to be integrated with a personal computer to continuously display a video image of the imaging apparatus. Upon proper input by a user, or automatically after a timed interval, a snapshot of the video image is captured. An autodiscrimination process of the captured video image automatically decodes any bar-coded information present in the captured image and outputs the information.

U.S Patent No. 5,992,750 to Chadima, Jr. et al. discloses an improved bar code reader unit which is hand-held and has improved focussing and illumination structure.

U.S. Patent No. 5,992,744 to Smith et al. discloses an apparatus and method for reading optically encoded symbols which are of types which are not known in advance and which have significantly different illumination and imaging requirements. The apparatus and method use at least two optical scanning assemblies which have different illumination systems, different spatial resolutions and at least partially overlapping depth of field. These optical scanning systems are so located with respect to one another that a target symbol may be read by both scanning assemblies without the apparatus being manually reconfigured or moved during the reading process.

U.S. Patent No. 5,986,705 to Shiboya et al. discloses an exposure adjustment apparatus which determines whether the exposure time or the gain is to be decreased, increased or maintained, and controls the gain of an amplifier and the drive pulse to be generated by a drive pulse generator. Thereby, the output signal level is adjusted by controlling only the exposure time of the solid state image sensing device and the gain of the video signal resulting in a compact and vibration-resistant exposure control system which is inexpensive.

U.S. Patent No. 5,979,763 to Wang et al. discloses sub-pixel processing of image data representing a dataform, such as a 2D bar code, enables reading of dataforms including more data/smaller elements, without costly increases in sensor and memory capacity. Whole pixel processing is employed for pixel-per-element resolutions of two or better. Sub-pixel cell edge transition location in image data is enhanced by use of a dynamically implemented noise margin applied with bands of gray scale values designated within the envelope of applicable gray scale maximum and minimum values. Sub-pixel cell edge transition location employs selection of transition segments (subject to the noise margin) and determination of a dynamic threshold for each relevant transition segment. The intersection of the threshold and the transition segment is then indicative of the location of the cell edge transition along a sampling line crossing the dataform. The process is repeated for successive cell edges along image data sampling lines and for additional sampling lines crossing successive rows of dataform elements. Run length data representing cell edge transition locations is constructed and usable for dataform decoding.

U.S. Patent No. 5,965,863 to Parker et al. discloses an optical reading system comprising an optical reader and a host processor which is adapted for reprogramming the reader and for other interactions with the reader. In one embodiment, the host processor may be configured to read a parameter table stored in a memory space of the reader, execute commands to edit the parameter table and write the edited parameter table back to the reader memory space, or to another location such as to a bulk storage device for use in reprogramming additional readers. In another embodiment, the host processor may be in communication with a host memory space that stores a plurality of candidate parameter tables, and may be configured to read and edit the candidate parameter tables from the host memory space.

U.S. Patent No. 5,949,057 to Feng discloses a portable data collection device which includes an imaging assembly including a two dimensional photosensor array. The imaging

assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing an image of the target object in the target area. The device also includes an illumination assembly including a circuit board assembly supporting illumination and targeting light emitting diodes and a lens array or panel positioned adjacent the circuit board assembly for focusing an even pattern of illumination on the target area and generating a crosshair illumination pattern for aiming the device at the target dataform. These illumination assembly embodiments are disclosed. In a first embodiment, a lens array is disclosed having a first targeting optics generating a vertical illumination pattern and a second targeting optics generating a horizontal illumination pattern which intersect to form a crosshair illumination pattern. In a second embodiment, a lens array is disclosed having a first targeting optics which generates a first crosshair illumination pattern and a second targeting optics generating a second crosshair illumination pattern, the first and second illumination patterns coinciding at a best focus position of an optic assembly of the imaging assembly. In a third embodiment, a lens array is disclosed having a first targeting optics which generates a half frame and a crosshair illumination pattern and a second targeting optics which generates a complimentary half frame and crosshair illumination pattern. At the best focus position, the first and second illumination patterns combine to generate a full frame and single crosshair illumination pattern.

U.S. Patent No. 5,949,052 to Longacre, Jr. et al. discloses a system for sensing the presence of an object in the field of view of an imaging assembly of a stationary position optical reader. The system includes a specialized symbol disposed in a stationary position in relation to the imaging assembly of a specially configured optical reader. An optical reader according to the invention is configured to determine whether an object is in the field of view of the imaging assembly and determining whether features of the specialized symbol are present in the image information.

U.S. Patent No. 5,942,741 to Longacre, Jr. et al. discloses a method and apparatus for optimizing the data throughput of decoded-output scanners by maintaining a tracking relationship between the scanning and decoding operations thereof. Data is scanned from an indicia to be read on an uninterrupted cyclic basis and stored in memory. Also stored is continuously updated data that allows the most recently completed block of scan data to be identified. Data is decoded on an uninterrupted cyclic basis, at the same time that new data is being scanned. A loose, tracking relationship is maintained between the scanning and decoding operations so that decoding always begins with the then most currently available data.

U.S. Patent No. 5,932,862 to Hussey et al. discloses an optical reading apparatus for scanning and decoding data encoded in any of a plurality of types of 1D and 2D bar code symbols. A scanner generates successive blocks of scan data for storage in a scan memory. The scan memory stores at least one complete block of scan data in one address space thereof while a more current block of scan data is being stored in another address space thereof. A processor selects and decides blocks of scan data in accordance with a selectable one of a plurality of scanning-decoding relationships, at least one of which is a racking relationship.

U.S. Patent No. 5,929,418 to Ehrhart et al. discloses an optical reading apparatus which is adapted to operate in the manner indicated by the enabled ones of the parameters stored in a parameter table. A processor stores at least a menuing program and a decoding program. If the apparatus decodes a symbol in accordance with the parameter table and determines that is a menu symbol, the menuing program is invoked to execute at least one of a change in the parameter table and the performance of a menu symbol specified task. If the apparatus decodes a symbol in accordance with the parameter table and determines that it is a data symbol, the data is output in the manner indicated by the parameter table.

U.S. Patent No. 5,920,061 to Feng discloses a portable data collection device adapted to read high density bar code and matrix dataforms. The device includes an imaging assembly including a modular camera housing supporting a two dimensional (2D) photosensor array. The imaging assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a image of the target object in the target area. The modular camera housing precisely positions an optic assembly such that the sharpest image of the target dataform is focused at a center point of the photosensor array. The optic assembly includes a plurality of lenses supported in a shroud assembly. The shroud assembly is adjustable to permit precise positioning of the lens assembly with respect to the photosensor array along a longitudinal optical axis of the lens assembly. The shroud assembly is supported within the modular camera housing such that the optical axis of the lens assembly is perpendicular with respect to the photosensor array.

U.S. Patent No. 5,914,476 to Gerst, III et al. discloses an optical reader which is made to commence image capture and decoding when a trigger of the reader is pulled, and to continuously attempt to decode symbols in captured image data until the time the trigger is released. Despite continuously attempting to decode symbols during the entire period in which a trigger is actuated, a reader according to the invention is made so as not to output data messages pertaining to the same symbol more than once during one trigger-actuation period. To this end, a reader operating according to the invention maintains a list of identification strings identifying all symbols which have been successfully decoded since the time the trigger was pulled. When symbols in image data are decoded, identification strings for those symbols are determined and then compared to identification strings previously written to the list. If an identification string for a successfully decoded symbol is not on the list, the reader outputs a data message for the symbol, and adds the identification string to the identification string list.

U.S. Patent No. 5,900,613 to Koziol et al. discloses an optical reading apparatus adapted to scan and decode data in accordance with the enabled ones of the parameters stored in a parameter table. The reader is equipped with random access and erasable read only memories, and with a processor having a menuing program that allows the contents of the parameter table to be changed by user presented menu symbols. The processor is programmed to respond to a reprogram command, generated by a data source external thereto, by allowing that external data source to change any one or more of the parameter table and the menuing program.

U.S. Patent No. 5,841,121 to Koenck discloses a hand-held optically readable information set reader having one or more photosensor arrays, at least one information set illuminator, and an information set image transfer system for projecting a readable image of an information set onto

the one or more photosensor arrays.

U.S. Patent No. 5,837,985 to Karpen discloses an imaging assembly having a 2D image sensor so oriented in relation to its supporting structure that, when a reader including the imaging assembly is held in its normal operating position during the reading of a 1D bar code symbol, the image of that 1D symbol is aligned with a diagonal of the image sensor, thereby increasing the resolution with which the 1D symbol is read. An image sensor including a generally rectangular 2D array of photosensitive elements is secured to a mounting structure so that the plane of the array is generally parallel to and approximately in the focal plane of an associated 2D imaging optics assembly. The angular orientation of the image sensor with respect to its mounting structure is selected so that, when a reader including the imaging assembly is held in its normal reading position during the reading of a 1D symbol, the image of the 1D symbol is formed along a diagonal of the array.

U.S. Patent No. 5,834,754 to Feng et al. discloses a portable data collection device that includes an imaging assembly including a two dimensional photosensor array. The imaging assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a color image of the target object in the target area. The imaging assembly further includes compression circuitry for compressing digital data representative of the target area when the imaging assembly is actuated to capture an image of the target area. The device also includes a viewing assembly to aid an operator in aiming and positioning the device with respect to a target dataform or target object. In one embodiment of the viewing assembly, a liquid crystal display screen is affixed to a pivoting member. When the viewing assembly is actuated an image of the target area is displaced on the display screen. In a second embodiment of the viewing assembly, a manual pivoting member includes an opening. When the pivoting member is positioned a predetermined distance from the operator's eye, a view through the opening corresponds to the imaging assembly's target area.

U.S. Patent No. 5,831,674 to Ju et al. discloses an image sensor array system which is addressable to enable readout of randomly selected image data from any one or more individual sensor cells, for any selected image area (13), or for the entire image area (15). The sensor array (16) is accessed by horizontal and vertical readout circuits (22 and 24) under the control of address signals from an address unit (20). Location signals, from a source (12), indicative of a selected image area (13) may be used by the address unit (20) to provide address signals representative of the location of a specific sensor cell or area (13) of the array including image data of interest. Under the control of the address signals, image data from cells at the intersection of array lines and columns are sampled by sampling devices (26-32) and provided as output signals representative of the selected portion of the image area at an output port (34). Simplified readout can be provided for oblique line components of images. Differing input bus widths enable different levels of cell or line selection.

U.S. Patent No. 5,831,254 to Karpen et al. discloses an exposure control apparatus for use with optical readers, such as bar code readers, which utilize photosensitive image sensors. An illumination signal generating circuit generates an illumination signal having a magnitude that

varies in accordance with the time averaged value of the illumination level at the image sensor. A window detecting circuit periodically samples the illumination signal to determine if that signal is or is not within a window of acceptability. Exposure period determining circuitry uses the output of the window detecting circuit to upwardly or downwardly adjust the value of a control variable as necessary to cause the illumination signal to approach, enter and remain within the window of acceptability.

U.S. Patent No. 5,825,006 to Longacre, Jr. et al. discloses a method and apparatus for autodiscriminating and decoding any of a plurality of ID linear bar code symbols which use different ID symbologies and of 2D matrix bar code symbols which use different 2D finder patterns and 2D symbologies. A processor stores a plurality of 1D decoding programs, a plurality of 2D decoding programs, and a parameter table that specifies which of said programs are to be enabled. During ID autodiscrimination, the processor makes no attempt to decode unknown symbols in accordance with 1D decoding programs that are not enabled. During 2D autodiscrimination, the processor makes no attempt to decode unknown 2D symbols in accordance with 2D decoding programs that are not enabled.

U.S. Patent No. 5,821,518 to Sussmeier et al. discloses a portable non-contact label imager that captures an image of two-dimensional information indicia on a label. The captured image data is decoded by a decoder. The label imager forms a part of a data terminal, which includes a keypad, display and signature capture pad. Upon receipt of a start signal from the data terminal's circuitry, the label imager automatically carries out the steps required to capture the label information indicia. The label imager provides aiming indicia to allow the user to properly aim the camera. A position sensing device determines when the target label is within the camera's depth of field. At that time, the label imager determines the shutter speed required for a correct label imager then captures the label image, which is decoded by the decoder. Corresponding output data is then provided to the data terminal.

U.S. Patent No. 5,815,200 to Ju et al. discloses an extended working range dataform reader with reduced power consumption and which has a camera assembly and a circuit control board including game control circuitry and exposure control circuitry configured to set an initial gain value and an initial exposure period, respectively, resulting from a previous dataform reading session. Subsequent fields of image data are captured by the camera which are used to correct the gain and exposure relative to the initial values for gain and exposure period, thereby reducing the latency period for realizing correct values and reducing power consumption during power up. Furthermore, the gain control system and the exposure control system each utilize an open loop feedback such that successive fields of image data captured by the camera are utilized to calculate correct values, thereby reducing the latency time for realizing a correct value. Additionally, a reader module is provided for use in a dataform reader that emulates a laser module such that the dataform reader module can be readily integrated into existing laser-based dataform reading systems. Preferably, laser model emulation circuitry included in the dataform reader module emulates output of a laser scan module and a control circuit board in which the emulation circuitry is realized has an output port constructed and arranged to communicate with devices configured for use with a laser scanner.

U.S. Patent No. 5,811,784 to Tausch et al. discloses a portable dataform reader which

includes a large optic assembly that provides a working range from about 2.5" to at least 8.5" in front of the reader while maintaining a broad field of view. The reader is capable of capturing a high signal to noise ratio image in under 0.01 seconds, thereby making the reader highly tolerant to hand jitter. To accommodate the large optic and short exposure period, the reader is provided with an efficient high intensity uniform illumination module.

U.S. Patent No. 5,811,774 to Ju et al. discloses an extended working range dataform reader with reduced power consumption having a camera assembly and a circuit control board including game control circuitry and exposure control circuitry configured to set an initial gain value and an initial exposure period, respectively, resulting from a previous dataform reading session. Subsequent fields of image data are captured by the camera which are used to correct the gain and exposure relative to the initial values for gain and exposure period, thereby reducing the latency period for realizing correct values and reducing power consumption during power up. Furthermore, the gain control system and the exposure control system each utilize an open loop feedback such that successive fields of image data captured by the camera are utilized to calculate correct values, thereby reducing the latency time for realizing a correct value. Additionally, a reader module is provided for use in a dataform reader that emulates a laser module such that the dataform reader module can be readily integrated into existing laser-based dataform reading systems. Preferably, laser model emulation circuitry included in the dataform reader module emulates output of a laser scan module and a control circuit board in which the emulation circuitry is realized has an output port constructed and arranged to communicate with devices configured for use with a laser scanner.

U.S. Patent No. 5,793,033 to Feng et al. discloses a portable data collection device that includes an imaging assembly including a two-dimensional photosensor array. The imaging assembly is selectively actuatable with a first trigger for reading a target dataform in the imaging assembly's target area and actuatable with a second trigger for capturing a color image of the target object in the target area. The imaging assembly further includes compression circuitry for compressing digital data representative of the target area when the imaging assembly is actuated to capture an image of the target area. The device also includes a viewing assembly to aid an operator in aiming and positioning the device with respect tot a target dataform or target object. In one embodiment of the viewing assembly, a liquid crystal display screen is affixed to a pivoting member. When the viewing assembly is actuated an image of the target area is displaced on the display screen. In a second embodiment of the viewing assembly, a manual pivoting member includes an opening. When the pivoting member is positioned a predetermined distance from the operator's eye, a view through the opening corresponds to the imaging assembly's target area.

U.S. Patent No. 5,786,586 to Pidhirny et al. discloses an optical reader is suitable for reading 2-dimensional indicia. The optical reading device, that may include a bar code reader, comprises a lens assembly and a guide detachably mounted on a front portion of the housing for establishing a distance between the lens assembly and an equipment target that is displaced a predetermined distance from a mark target wherein the optical reader further comprises an attaching member for supporting the lens assembly on the guide to form a detachable lens-guide assembly.

U.S Patent No. 5,786,583 to Maltsev discloses a method and apparatus for locating and decoding machine-readable symbols which stores an image of the symbol and locates all Jordan

curves having an angular length less than π within the image of the symbol. The present invention finds and selects all convex Jordan curves from the set of all Jordan curves found within the stored image. The present invention determines equations of a pair of tangent lines from end points of each convex Jordan curve and determines an equation of a center line for each pair of tangent lines. The present invention determines a point of intersection of the center lines, and based on the point of intersection, locates a center point of a finder pattern of the symbol. The present invention confirms that the located center point is indeed the center of the finder pattern, and thereafter decodes the symbol.

U.S. Patent No. 5,786,582 to Roustaei et al. discloses an optical device for reading one- and two-dimensional symbologies at variable depths of field, said device including a light source for projecting an emitted light towards the two-dimensional image and an optical assembly, or zoom lens, with dual field of view capability for focusing light reflected from the framed symbology onto a CCD detector for detecting the focussed light and generating a signal therefrom. The dual field of view capability enables scanning of both wide and narrow fields of view. An apodizing filter is provided within the optical assembly to increase depth of field. Aiming of the sensor to read the symbology is facilitated by a frame locator including a laser diode which emits a beam that is modified by optics, including diffractive optics, to divide the beam into beamlets having a spacing therebetween that expands to match the dimensions of the field of view of the sensor, forming points of light at the target to define the edges of the field of view. One or two sets of diffractive optics may be provided, with one set corresponding to each position, for each of the dual field of view positions of the zoom lens.

U.S. Patent No. 5,784,102 to Hussey et al. discloses a hand-held optical reader for reading 2D bar code symbols that includes an illuminating system for illuminating the symbol and an optical system for focusing an image thereof on a 2D image sensor. The image sensor is of the type which allows its imaging parameters, such as exposure, to be controlled by external circuitry. The reader also includes an image sensor processor which sets and changes the imaging parameters used by the image sensor as necessary to meet predetermined image quality criteria and to reduce the time necessary to complete a read operation.

U.S. Patent No. 5,783,811 to Feng et al. discloses a device wherein an imaging assembly includes a two dimensional photosensor array overlain by a RGB color filter. The imaging assembly includes an illumination assembly providing a relatively uniform illumination pattern over an imaging target area. The illumination assembly includes a plurality of sets of surface mount illumination mounted on a board and spaced apart lens array for focusing the LEDs on the target area. The lens array includes orthogonal cylindrical optical entry and exit surfaces aligned with each of the illumination LED sets. The optical entry surface defines illumination intensity distribution horizontally while the optical exit surface defines illumination intensity distribution vertically. The board also supports a pair of spaced apart targeting LEDs. The lens array includes aspherical optical entry surfaces and cylindrical optical exit surfaces aligned with each of the targeting LEDs. The cylindrical optical exit surfaces are tipped with respect to their corresponding aspherical optical entry surfaces and are orthogonal to each other providing an orthogonal or "crosshairs" illumination pattern for aiming the imaging assembly at a target.

U.S. Patent No. 5,780,834 to Havens et al. discloses a low profile optical unit for use in a 2D bar code reader. A vertically disposed light redirecting panel having contoured reflective openings therein is mounted in the front of the unit and a LED behind the panel. Light emitting diodes for illuminating a target are mounted on the LED board behind the contour openings whereby direct light and reflected light illuminate a target. As imager housing is mounted on the back of the LED board and contains a recess that passes through the back of the housing and a lens barrel that extends forward through holes provided in the LED board and the light redirecting panel. An imager board is secured to the back of the housing which holds a 2D imager that is contained within the housing recess. Circuitry for generating image data signals is mounted on the back of the imager board. A lens holder is threadably mounted in the lens barrel which contains a lens system having a short back focal length for focusing a target image on the imager.

U.S. Patent No. 5,773,810 to Hussey et al. discloses a method for generating, substantially in real time, a user perceptible indication of the degree to which the distance between a handheld imaging device and a target object approximates the in-focus distance therebetween. A stored image of the target object is sampled, in accordance with a pattern of sampling addresses, to determine the magnitude of the slopes of the transitions of the stored image. The stored image is also sampled to determine the contrast value of the stored image. The highest magnitude slope values and the image contrast value are combined to produce a focus metric signal that is indicative of the degree to which the imaging device approximates an in-focus condition. The focus metric signal is then used to generate a user perceptible signal that can be utilized by an operator to move the imaging device toward its in-focus distance.

U.S. Patent No. 5,773,806 to Longacre, Jr. discloses a method and apparatus for capturing and storing a decodable representation of a 1D or 2D bar code symbol using a hand-held bar code reader having only a 1D image sensor. A succession of 1D digital representations are produced as the reader is moved asynchronously across the symbol to be read. These representations are examined, substantially in real time, and, if the symbol is a 1D symbol, is decoded immediately. If the symbol is not a 1D symbol, these representations are examined for the presence of one of a variety of different types of 2D finder patterns and, when the finder has been identified, decoded with reference to that finder pattern.

U.S. Patent No. 5,756,981 to Roustaei et al. discloses an optical device for reading one- and two-dimensional symbologies at variable depths of field. The device has a light source for projecting emitted light toward the symbol image to be reflected back to an optical assembly, or zoom lens. The zoom gives multiple field of view capability to a CCD detector for detecting the reflected light, and generating a proportional electrical signal. The sensor is aimed for reading the symbology by a frame locator including a light source that emits a beam divided by diffractive optics into beamlets matching the dimensions of the respective field of views. Refractive optics are shifted in response to movement of the zoom lens for aiming the beamlets to form an aiming frame in accordance with the depth of field selected by the zoom lens. The device includes a microcomputer that communicates with a host PC including an API library with downloadable applications for image processing including segmenting, analyzing, and decoding.

U.S. Patent No. 5,739,518 to Wang discloses a hand-held reader enabled to autodiscriminate among different 1D and 2D bar codes and matrix codes using image features distinctive for different dataforms, such as 1D bar codes, 2D bar codes and matrix codes. If the sampled image data permits identification of a specific type of dataform, a decoder employing a suitable decoding protocol is used to decode the dataform. Iterative use of additional image features and sampling patterns increases the accuracy of dataform identification. Data decoded from each incoming dataform is recoded and autotranslated into a preselected standardized dataform label placed on each respective package. Subsequent reading of package dataforms thereby requires reading and decoding of only the single standardized dataform format. Systems and methods are described.

U.S. Patent No. 5,736,724 to Ju et al discloses an image sensor array system arranged to enable oblique access for readout of image data from a stepped pixel pattern of sensor cells. The stepped pixel pattern represents an oblique line component of an image portion containing a 2-D bar code or other dataform. An obliquely aligned bar code image can thus be read out along oblique lines which follow rows of bar code elements traversing the elements. The sensor array (16) is accessed by horizontal and vertical readout circuits (22 and 24) under the control of address signals from an address unit (20). Location signals, from a source (12), indicative of a selected image portion (39) may be used by the address unit (20) to provide address signals representative of the stepped pixel pattern for a particular oblique line component. Under the control of the address signals, image data from cells at the intersection of array lines and columns are sampled by sampling devices (26-32) and provided as output signals representative of the selected oblique line component. The output signals are then usable for decoding the bar code or other dataform.

U.S. Patent No. 5,719,384 to Ju et al. discloses an image sensor array system arranged to enable oblique access for readout of image data from a stepped pixel pattern of sensor cells. The stepped pixel pattern represents an oblique line component of an image portion containing a 2-D bar code or other dataform. An obliquely aligned bar code image can thus be read out along oblique lines which follow rows of bar code elements traversing the elements. The sensor array is accessed by horizontal and vertical readout circuits and under the control of address signals from an address unit. Location signals, from a source, indicative of a selected image portion maybe used by the address unit to provide address signals representative of the stepped pixel pattern for a particular oblique line component. Under the control of the address signals, image data from cells at the intersection of array lines and columns are sampled by sampling devices and provided as output signals representative of the selected oblique line component. The output signals are then usable for decoding the bar code other dataform.

U.S. Patent No. 5,717,195 to Feng et al. discloses a fixed position dataform reader that reads a dataform printed on a substrate and passes through a desired target area. The reader comprises a housing, a first camera assembly, image processing and decoder circuitry, and a mounting support. The housing has a base surface, a face surface, and at least one side surface interconnecting the base surface to the face surface and defining an interior region. The face surface defines an aperture. The first camera assembly includes a two-dimensional photosensor array supported in the interior region and an optics assembly spaced from the two-dimensional photosensor array to focus an image of the dataform onto the two-dimensional photosensor array. The image processing and decoder circuitry is coupled to the camera assembly for generating decoded data representative of the dataform. The mounting support is secured to the housing for

mounting the reader in a fixed position with respect to the desired target area.

U.S. Patent No. 5,659,167 to Wang et al. discloses an interactive decoding of machine readable dataforms which provides improved control of decoding avoiding inaccurate reading of dataforms. While data is entered and an image of the resulting dataform, such as a data code matrix or two-dimensional bar code, is displayed and continuously updated as the dataform fills with entered data. Using the display and an input unit such as a keyboard, digitizer or scanner, data can be edited to add, modify or delete data while observing the resulting dataform. On completion, the final dataform codesignals are provided for further use or a copy of the dataform is provided by printing, for example. During decoding, an image of the dataform as captured by a reader, such as a laser scanner, CCD matrix or CMOS camera, is displayed. Observing the display, the operator can determine if the image is too small, out of focus, partially out of view, etc., and take action to improve the reader performance. The dataform is then decoded with improved accuracy and data signals are displayed or printed out or provided for further use. Automated image monitoring and reader adjustment is also described. Methods and systems for interactive decoding of dataforms are described.

U.S. Patent No. 5,646,390 to Wang et al. discloses dataform readers and methods that provide operation with a sequence of overlapping exposure periods for successive lines of sensor elements of an array. Also, the exposure periods for successive lines of sensor elements, or successive subsets of lines, can be independently determined. In operation of a dataform reader illumination of a target area is turned on before exposure of the first line of sensor elements, each line of sensor elements is exposed by reflected illumination in an exposure period which overlaps with the exposure period of one or more other lines, and illumination is then turned off. Using a CMOS construction, for example, the level of image signals read from one line of sensor elements is referred to a look-up table to determine an appropriate exposure period for a subsequent line or lines of elements of an array. This process is repeated to achieve exposure periods adjusted for localized exposure conditions for each successive line or subset of lines of sensor elements.

U.S. Patent No. 5,623,137 to Powers et al. discloses an apparatus for illuminating an indicia in a sensing region of an object plane. A housing has a median longitudinal vertical plane and a horizontal scanning plane. A reflector for reflecting light directed thereagainst toward the sensing region has a first approximately curvilinear profile in a plane parallel to the scanning plane, and a second approximately curvilinear profile in a plane parallel to the median longitudinal plane. The central portion of the reflector defines an opening whereby light from the sensing may return in generally the same plane as light directed toward the sensing region.

U.S. Patent No. 5,572,006 to Wang et al. discloses an automatic exposure imaging system operating on a single frame image capture basis that is adapted for single chip CMOS type construction. For reading dataforms, such as two-dimensional bar codes and matrix codes, the system can provide automatic gain control, automatic exposure control, automatic focus sensing and single frame imaging and decoding, with reduced power consumption. A fixed focus distance sensor element array assembly and optical distance sensing enable automatic initiation of exposure when the image is in-focus. Exposure provided by image illuminators is automatically controlled by sensing of the cumulative level of reflected light during the exposure period. Alternatively, exposure time is determined from a look-up table, based upon the level of light reflected during an initial illumination period of fixed duration. Automatic system turn-off or re-reading can be

provided, depending upon whether a dataform is successfully decoded. Power use is reduced by terminating the reading of sensor elements upon successful decoding. A complete, light-weight, hand-held reader is described, including provision for transmission of decoded dataform information and a wide range of additional capabilities via plug-in cards.

U.S. Patent No. 5,550,366 to Roustaei discloses an optical scanner which has an optical scanning head with LED light sources, focusing and receiving optics and a CCD detector array all mounted on a printed circuit board. This assembly, along with a storage buffer and a decoder is contained within a small housing which is attached on its lower side to a semi-glove which the user can wear on the back of his or her hand. The automatic sensing feature of the invention provides hands-free operation by automatically and periodically testing for the presence of a bar code in the scanner's field of view. If the presence of a bar code is detected, the scanner is placed in active mode. When the scanner is not in use, the scanner is powered down to conserve energy.

U.S Patent No. 5,541,419 to Arackellian discloses a symbology reader which reduces the effects of specular reflection. A plurality of illumination sources emit light toward a target object. A first polarization filter receives the unpolarized light from the illumination sources and transmits only light polarized in a first direction. Light reflected from the target object travels back to the reader where it is received by a second polarizer which is oriented to block light polarized in the first direction and transmit only light polarized in a second direction orthogonal to the first polarization direction. Non-specularly reflected light reflected from the target object is largely transmitted by the second polarizer to a detector assembly within the symbology reader. In one embodiment the polarization filters are part of a window which covers an output aperture of the reader. The polarization filters are implemented as discrete pieces of laminar polarizing film attached to a transparent window base. In an alternative embodiment, a wavelength filter is employed to block ambient light at wavelengths other than the wavelength of the illumination sources to improve the sensitivity of the detector assembly to reflected illumination light.

U.S. Patent No. 5,532,467 to Roustaei discloses an optical scanning head which includes at least one trio of light emitting diodes arranged so the LEDs emit light at different angles create a fan of light. An optical module includes a light shield or "dark room" and a lens/filter assembly which provides control of the depth of focus of the scanner. The optical module is located behind the light source, and the detector, made up of a CCD array is mounted behind the optic module for detecting the light intensity in the reflected beam over a field of view across a bar code symbol. The CCD array generates an electrical signal indicative of the detected light intensity. A DC source or battery provides DC voltage to the LEDs and CCDs in response to a clocked signal which provides a gradual or sequential illumination of the LEDs and coordinates the activation of the CCDs in order to minimize power consumption during scans.

U.S. Patent No. 5,521,366 to Wang et al. discloses dataform readers and methods that provide operation with a sequence of overlapping exposure periods for successive lines of sensor elements of an array. Also, the exposure periods for successive lines of sensor elements, or successive subsets of lines, can be independently determined. In operation of a dataform reader

illumination of a target area is turned on before exposure of the first line of sensor elements, each line of sensor elements is exposed by reflected illumination in an exposure period which overlaps with the exposure period of one or more other lines, and illumination is then turned off. Using a CMOS construction, for example, the level of image signals read from one line of sensor elements is referred to a look-up table to determine an appropriate exposure period for a subsequent line or lines of elements of an array. This process is repeated to achieve exposure periods adjusted for localized exposure conditions for each successive line or subset of lines of sensor elements.

U.S. Patent No. 5,463,214 to Longacre, Jr. et al. discloses a method of improving throughput in a scanner whose scanning action is capable of being stopped and started instantly, comprising the steps of A) storing results of a first scan of a target containing indicia in a first region of a memory and B) upon determining that the first scan is complete 1) decoding results of the first scan 2) initiating a second scan, 3) storing results of the second scan of the target containing indicia in a second region of a memory, and 4) awaiting completion of the decoding before initiating an additional scan.

U.S. Patent No. 5,420,409 to Longacre, Jr. et al. discloses a method for reading graphical indicia that are encoded in accordance with a multidimensional symbology. The indicia are repeatedly scanning a signal representative of a pattern thereof until sufficient information is recognized to assure a valid reading operation. The signal, or a memorized representation thereof is decoded to obtain character information from code words of the indicia. A first value is assigned to each newly recognized character, and a second value is assigned to each character that was recognized in a preceding scan of the indicia. The first and second values are respectively cumulated into first and second sums. A function of the first sum and the second sum is computed, an audible click produced whenever a predetermined value of the function has been attained. The first and second sums are then reset. The rate of clicks informs the user of the progression of the reading operation. An auxiliary audible indicator, such as pitch, can be varied to inform the user of the cumulative progress of the scan.

U.S. Patent No. 5,418,357 to Inoue, et al. discloses a bar-code reader permitting selective use of a whole or a part of an image sensor.

U.S. Patent No. 5,410,141 to Koenck et al. discloses battery powered hand-held data entry terminals wherein a peripheral module may contain an automatically operating full image reader and a wireless communication unit. The reader reads at least one full line of indicia and may comprise a laser bar code scanner or a flash type image reader. Preferably the reader has uniform resolution in orthogonal directions in the field of view so that an area image can be read at any arbitrary angular orientation and re-oriented as a stored digital image to a normalized orientation before decoding. The user interface may lie in a first longitudinally extended layer and the peripheral module may lie in a second longitudinally extended adjoining layer. In normal reading disposition of the automatic reader, the user interface may be close to its normal orientation for user interaction therewith to provide for smooth transitions between reading and user interaction operations. A hand grip portion preferably underlies the user interface for comfortable support thereof during manual actuations. The peripheral module and hand grip portion may be used

entirely separately from the user interface and may have a wireless link with the user interface. The user interface may comprise a digitizer/display with resolution for accurately digitizing and displaying a person's signature. Signatures may also be digitized via an optical full image reader for immediate verification.

U.S. Patent No. 5,378,883 to Batterman et al. discloses a hand-held bar code reader with a two dimensional image sensor for omnidirectional bar code reading, including variable imaging optics and flash illumination with variable flash illumination optics. A spotter beam is provided for aiming the hand held bar code reader at a bar code symbol. The spotter beam is also used to measure the range to said bar code from said hand held bar code reader and to determine the focal length of said variable imaging optics and variable flash illumination optics. The imaging optics are adjusted automatically to provide the correct magnification and focus of a bar code regardless of range to the label. The variable focal length flash illumination optics are used to concentrate illumination energy only in the field of view of the bar code reader. The flash illumination energy is conserved by measuring the ambient light and setting the level of flash illumination energy in accordance with the measured level of ambient light. In such manner, conventional, damaged, multiple, and stacked bar code symbols along with true two dimensional codes may be rapidly read over distances from under one foot to over several feet without having to along the bar code reader to the bar code.

U.S. Patent No. 5,354,977 to Roustaei discloses an optical scanning head for scanning one- and two-dimensional bar codes including at least one combination of light emitting diodes arranged so the LEDs emit light at different angles to create a fan of light. The combination and arrangement of the LEDs depends on whether one- or two-dimensional bar codes are to be read. A cylindrical lens optimizes the light impinging upon the bar code. An optical module includes a light shield or "dark room" and a lens/filter assembly which focuses reflected light on the detector, made up of a CCD module for detecting the light intensity in the reflected beam over a field of view across a bar code symbol. One or more combinations of linear CCD arrays in the CCD module generate an electrical signal indicative of the detected light intensity. A trigger mechanism allows selection of the number of LEDs or linear CCD arrays to efficiently scan one- or two-dimensional bar codes, where two-dimensional bar codes require more illumination for accurate scanning.

U.S. Patent No. 5,349,172 to Roustaei discloses an optical scanning head which includes at least one trio of light emitting diodes arranged so the LEDs emit light at different angles to create a fan of light. An optical module includes a light shield or "dark room" and a lens/filter assembly which provides control of the depth of focus of the scanner. The optical module is located behind the light source, and the detector, made up of a CCD array is mounted behind the optic module for detecting the light intensity in the reflected beam over a field of view across a bar code symbol. The CCD array generates an electrical signal indicative of the detected light intensity. A DC source or battery provides DC voltage to the LEDs and CCDs in response to a clocked signal which provides a gradual or sequential illumination of the LEDs and coordinates the activation of the CCDs in order to minimize power consumption during scans.

U.S. Patent No. 5,319,181 to Shellhammer et al. discloses a method and apparatus for decoding a two-dimensional bar code symbol using a charge-coupled device (CCD) camera or a charge-modulation device (CMD) camera. The CCD/CMD camera takes pictures of the symbol

and the picture is converted into digital data. The location and orientation of the two-dimensional bar code symbol is determined and verified. Defects and damages on the symbol are detected and corrected. The symbol is scanned to read the codewords of the two-dimensional bar code symbol.

U.S. Patent No. 5,304,786 to Pavlidis et al. discloses a nonvolatile electro-optical read-only memory which includes a substrate on which is printed (or otherwise inscribed) a complex symbol or "label" with a high density two-dimensional symbology, a variable number of component symbols or "codewords" per row, and a variable number of rows. Codewords in alternating rows are selected from mutually exclusive subsets of a mark pattern such as a (17,4) mark pattern. The subsets are defined in terms of particular values of a discriminator function, which is illustrated as being a function of the widths of bars and spaces in a given codeword. In the illustrated embodiment, each subset includes 929 available codewords; that, plus a two-step method of decoding scanned data, permitting significant flexibility in defining mappings of human-readable symbol sets into codewords. The memory may be used in conjunction with a scanner and a suitable control system in a number of applications, e.g., robotic operations or automated microfilm searching.

U.S. Patent No. 5,296,689 to Reddersen et al. discloses an optical scanning system including an aiming system which is particularly suitable for handheld scanners where the outgoing light is scanned over a desired angle in a scan plane. The aiming system includes a light source generating an optical beam along an outgoing optical path toward an object to be scanned,; a detector for detecting light reflected off the object, an oscillating scan mirror in the outgoing optical path directing light toward the object along a scan plane; and a diffractive optical module positioned in the outgoing optical path adjacent the scan mirror, the diffractive optical module having a pair of diffractive optical elements separated by an aperture, the diffractive optical elements positioned on either side of an aperture along the scan plane, each diffractive optical element de-scanning the portion of the optical beam passing therethrough to form an aiming light beam.

U.S. Patent No. 5,288,985 to Chadima, Jr. et al. discloses a hand-held bar code reader that has a handle portion and a reader head portion which may be held spaced from a bar code data carrier during a reading operation. Light energy is directed outwardly through a window so as to illuminate a bar code sensing region in front of the window having a depth dimension of at least about ten millimeters, and an optical system focuses bar code patterns in the sensing region onto an image photosensor in the reader unit with a resolution so as to read bar code formats with a minimum bar or space width of about 0.0075 inch, or even less. Preferably the light source is of an electronically triggerable instant response type and is located substantially within the reader head portion. The bar code image is converged through a generally rectangular optical aperture and is reflected by reflected light gathering means in a folded return path to a photodetector. The reflected light gathering means and the photodetector are mounted on a single printed circuit board. The reflected bar code image is decoded by a battery powered programmed decoder located substantially within the handle portion.

U.S. Patent No. 5,286,960 to Longacre, Jr. et al. discloses a method and apparatus are provided for detecting bar-space and space-bar transitions in a bar code symbol. A sequence of sparsely sampled analog signals from a photodetector in a bar code scanner is representative of the

reflectance pattern of a symbol. Following initialization, a threshold, representing the value of the analog signal at a transition point, is derived from observed samples of the bars and spaces in the bar code symbol. Sampled reflectance information is accumulated as the symbol is scanned, and a program driven microprocessor calculates and repeatedly updates this threshold, using observed maxima and minima in the analog samples, and also referencing a binary output to determine whether a bar or space is currently being viewed. When the values of two successive analog samples bracket this threshold, then a bar-space or space-bar transition has occurred. Linear interpolation is performed on the two samples to determine the transition point and an offset from the first of the two samples. After a delay corresponding to this offset, the level of a binary output is changed. A bit serial binary output is thus produced, representative of the relative widths of bars and spaces.

U.S. Patent No. 4,471,228 to Nishizawa et al. discloses a solid-state image sensor which detects the quality of light incident on image sensor cells during exposure and performs exposure control in accordance with an exposure value thus obtained. The solid-state image sensor is provided with a photoelectric converter having a plurality of non-destructive readout type image sensor cells arranged in a matrix form; an exposure detector for reading out stored information of predetermined ones of the image sensor cells during exposure, obtaining an added value of the stored information thus read out and detecting that the added value reaches a predetermined level, an exposure controller which is supplied with the detected signal from the exposure detector to control at least one of the charge storage time of each image sensor cell by an optical signal, the intensity of light incident on the image sensor cell and the photosensitivity of the image sensor cell; and a scanner for scanning the photoelectric converter to read out stored information of the image sensor cells during exposure.

U.S. Patent No. 4,338,514 to Bixby discloses an apparatus for controlling the exposure of a solid state image sensor array which monitors the semiconductor substrate current produced as charge signal accumulated during exposure of the array to radiant energy. The exposure of the array is controlled in response to an output signal representative of the total substrate current.

U.S. Patent Application No. US D442,152 S discloses an ornamental design for a multipurpose portable wireless video appliance.

Reissued Patent Application No. 36,528 to Roustaei discloses a design for a bar code Scanner using the Light Emitting Diode (LED), Optical Scanner assembly and Charge-Coupled Devices (CCD) capable of reading the barcode symbols at the variable distance as well as optical passive elements for increasing the depth of field and method of fabricating the scanning head by mass-production techniques.

U.S. Patent Application No. 2004/0195328 to Barber et al. discloses an imaging module which includes a frame supporting various optical components and a circuit board, which, in one embodiment, carries essentially an entirety of illumination and aiming LED's of the module. The frame may include resilient fingers which enable the frame to receive certain optical components in a snap-fit arrangement. Further, the module may be arranged so that the outer walls of the module provide a containment for preventing structural damage to sensitive internal components of the module.

U.S. Patent Application No. 2004/0094627 to Parker et al. discloses an optical reading system which comprises an optical reader and a host processor, wherein the host processor may be configured to transmit a component control instruction in response to a user input command input by a user of the host processor to remotely control the reader. The optical reader subsequently receives the transmitted component control instruction and executes the component control instruction substantially on receipt thereof. In one embodiment, execution of the component control instruction by the optical reader has the same effect as the reader trigger being manually pulled by a reader operator.

U.S. Patent Application No. 2004/0004125 to Havens et al. discloses a method and apparatus for increasing the operating depth of field for a bar code scanner, preferably a laser scanner, by placing a cubic phase mask (CPM) in the scanning beam. The masked beam is then scanned and reflected off a bar code and received by a photodetector. The received signal is then processed to recover the original unperturbed representation of the bar code pattern. The processed signal has an increased depth of field over an unmasked scanner signal.

U.S. Patent Application No. 2004/0000592 to Schwartz et al. discloses an apparatus for adjusting the position of a line of light in barcode space that includes a support frame having a rear housing containing a solid state imager and a pair of support arms extending forwardly from the front of the housing. An imaging lens is mounted between the arms for focusing an image of a target in barcode space upon the solid state imager along the optical axis of the imaging lens. Illuminating LEDs are mounted on either side of the imaging lens for illuminating the target. The illumination is passed through a pair of cylindrical lenses that are adjustably mounted upon the distal ends of the arm so that the light can be selectively positioned in barcode space.

U.S. Patent Application No. 2003/0218069 to Meier et al. discloses a system wherein the control unit of an optical reader analyzes image data being generated by the imaging element of the reader and changes the mode of operation of the reader if the image data indicates that machine readable indicia, such as a bar code symbol or a text character, is likely in the field of view of the reader. Normally, analysis of image data includes the step of detecting for edge transitions in the image information. If the control unit determines that the image data includes more than a predetermined number of edge transitions, then the control unit imparts appropriate control over various reader elements to change the mode of operation of the reader. Normally, the control unit changes the mode of operation of the reader from a first mode, wherein the reader does not operate to decode or recognize image data to a second mode, wherein the reader operates to decode and/or recognize image data.

U.S. Patent Application No. 2003/0213847 to McCall et al. discloses an imaging module that includes various optical components and a circuit board, which, in one embodiment, carries essentially an entirety of illumination and aiming LEDs of the module. The module includes a combination of features which result in the size of the module being reduced. The module may comprise a refractive optic diffuser plate manufactured using a textured surface mold.

U.S. Patent Application No. 2003/0209603 to Schwartz et al. discloses an optical assembly

for use in a barcode reader that includes a frame having a rear housing and a pair of arms outwardly extended from the housing. An optical card containing an imaging lens is slidably received in a rear guideway situated between the arms. An aperture card is slidably received in a front guideway situated between the arms in front of the lens. Lamp support brackets are also mounted to either side of the arms. Each bracket contains a pair of LEDs that are aligned in coplanar relation with the imaging lens. A cylindrical lens is mounted in front of the lamp support brackets within the arms of the frame to magnify and focus the illumination from the LED upon a target in barcode space. A horizontally extended field stop aperture is positioned in front of each LED.

U.S. Patent Application No. 2003/0197063 to Longacre, Jr. discloses a bar code reader which captures an initial image map corresponding to a scene, then subjects the initial image map to an interpolation step wherein values for constructed pixels positionally intermediate pixel values of the initial image map are interpolated as a function of the initial image map pixel values bordering the constructed pixels. After an interpolated image map is constructed, the interpolated image map is subjected to a binarization step wherein grey scale pixel values of the interpolated image map are converted into binary (1 or 0) pixel values by way of a thresholding process. In the thresholding process, grey scale pixel values are compared to a threshold in the grey scale range, then set to 1 if they are above the threshold and set to 0 if below the threshold. The pixel values of the resulting binarized interpolated image map are then analyzed to determine the identity of a message which may be encoded in any symbol which may be represented in the binarized interpolated image map.

U.S. Patent Application No. 2003/0085282 to Parker et al. discloses an optical reading system comprising an optical reader and a host processor. In one aspect of the invention, the host processor may be configured to transmit a component control instruction in response to a user input command input by a user of the host processor to remotely control the reader. The optical reader subsequently receives the transmitted component control instruction and executes the component control instruction substantially on receipt thereof. In one embodiment, execution of the component control instruction by the optical reader has the same effect as the reader trigger being manually pulled by a reader operator.

U.S. Patent Application No. 2003/0062419 to Ehrhart et al. discloses an optical reader that includes a color imaging assembly that generates color imaging data. An image analysis circuit determines if the acquired image should be characterized as a color photograph or as including a graphical symbol. A processing circuit processes the imaging data based on the image analysis circuit's determination of whether the image is a graphical symbol or a color photograph. The present invention allows a user to acquire and process both color images and graphical symbols, such as bar codes, text, OCR symbols or signatures. The optical reader of the present invention is also configured to associate an acquired image with at least one other acquired image.

U.S. Patent Application No. 2003/0062418 to Barber et al. discloses an optical reader which has a 2D image sensor that is configured to operate in a partial frame capture mode. In a partial frame operating mode, the reader clocks out and captures at least one partial frame of image data having image data corresponding to less than all of the pixels of an image sensor pixel array. In one embodiment, the reader operating in a partial frame operating mode captures image

data corresponding to a linear pattern of pixels of the image sensor, reads the image data, attempts to decode for a decodable 1D symbol which may be represented in the image data, and captures a full frame of image data if the image data reading reveals a 2D symbol is likely to be present in a full field of view of the 2D image sensor.

U.S. Patent Application No. 2002/0191830 to Pidhirny discloses an indicia reader which, in addition to having magnetically encoded information reading capabilities in one embodiment, includes image sensing capabilities. A compact housing is provided which receives an indicia bearing member. Mounted on the housing in one embodiment are an imaging assembly, and a magnetically encoded information reader, which form an indicia-determining unit, and a transport mechanism for transporting the indicia-determining unit and a received member relative to one another. The reader may further include a data format engine in communication with the indicia-determining unit.

U.S. Patent Application No. 2002/0179713 to Pettinelli et al. discloses an exposure control apparatus for use with optical readers, such as bar code readers, which utilize photosensitive image sensors. An illumination signal generating circuit generates an illumination signal having a magnitude that varies in accordance with the illumination level at the image sensor. A window detecting circuit samples the illumination signal during a predetermined part of each scan to determine whether the illumination signal is within the window, has exited the widow, or has re-entered the window. Exposure control circuitry uses the output of the window detecting circuit to control which of a plurality of the subdivisions of the exposure control range of the image sensor will be used. Changes in exposure time are made only between adjacent subdivisions of the exposure control range. Together with a predetermined hysteresis between the exit and re-entry thresholds of the window, the latter changes stabilize the operation of the reader by reducing exposure control "hunting".

U.S. Patent Application No. 2002/0171745 to Ehrhart discloses an imaging device equipped with decode functionality configured to operate in at least one of four user selected modes. In a first, "message only" mode, the device stores into a designated memory location a decoded-out message corresponding to a decodable indicia. In a second, "image only" mode, the device stores into a designated frame storage memory location an image representation of a scene. In a third, "image plus message" mode the device stores into a designated frame storage memory location an image representation comprising a representation of a decodable symbol and into the same or other memory location the decoded-out message decoded from the decodable indicia, or data corresponding to the same. In the fourth, "two-step message and image" mode, the device is controlled to capture an image a first time for decoding a decodable indicia and a second time for capturing an image that is associated with the decoded-out message corresponding to the decodable indicia.

U.S. Patent Application No. 2002/0170970 to Ehrhart discloses an imaging device which in one embodiment is equipped with decode functionality and is configured to operate in at least one of four user selected modes. In a first, "message only" mode, the device stores into a designated memory location a decoded-out message corresponding to a decodable indicia. In a second, "image only" mode, the device stores into a designated frame storage memory location an image representation of a scene. In a third, "image plus message" mode the device stores into a

designated frame storage memory location an image representation comprising a representation of a decodable symbol and into the same or other memory location the decoded-out message decoded from the decodable indicia, or data corresponding to the same. In the fourth, "two-step message and image" mode, the device is controlled to capture an image a first time for decoding a decodable indicia and a second time for capturing an image that is associated with the decoded-out message corresponding to the decodable indicia.

U.S. Patent Application No. 2002/0150309 A1 to Hepworth et al. discloses a method for increasing the readability of a machine-readable graphical code on a printing surface. The method includes receiving a graphical code image. The graphical code image is an electronic representation of a graphical code. The graphical code image includes a white region and a non-white region adjacent to the white region. The method also includes determining a size increase of the non-white region. The size increase indicates how much the size of the non-white region will increase when the graphical code image is printed on the printing surface. The method also includes creating a size compensated graphical code image by reducing the size of the non-white region by an amount that will substantially compensate for the size increase of the non-white region.

U.S. Patent Application No. 2002/0096566 to Schwartz et al. discloses an apparatus for adjusting the position of a line of light in barcode space that includes a support frame having a rear housing containing a solid state imager and a pair of support arms extending forwardly from the front of the housing. An imaging lens is mounted between the arms for focusing an image of a target in barcode space upon the solid state imager along the optical axis of the imaging lens. Illuminating LEDs are mounted on either side of the imaging lens for illuminating the target. The illumination is passed through a pair of cylindrical lenses that are adjustably mounted upon the distal ends of the arm so that the light can be selectively positioned in barcode space.

U.S. Patent Application No. 2002/0008968 to Hennick et al. discloses a multilayered image sensor is back mounted to a plate, and the plate in turn, is installed in a holding pocket of a device. In that the scheme takes advantage of a high controllability of a mounting plate's thickness, the mounting scheme provides a tight control of holding forces with which an image sensor is secured in an imaging device. In that the scheme provides for back mounting of image sensor on a planar surface, the mounting system provides tight control of an imaging assembly's pixel plane to fixed point in space distance.

Code Reader 2.0 – promotional papers provide many illustrations and examples.

Code Corporation's New Imager Offers Revolutionary Performance and Bluetooth Radio defines how Code Reader 2 will change the bar code reading industry.

The product brochure for National Semiconductor Corporation's LMC555 CMOS Timer describes a version of the industry standard 555 series purpose timers. In addition to the standard package (SOIC, MSOP, and MDIP) the LMC555 is also available in a chip sized package (8 Bump micro SMD) using National's micro SMD package technology. The LMC555 offers the same capability of generating accurate time delays and frequencies as the LM555, but with much lower power dissipation and supply current spikes. When operated as a one-shot, the time delay is

precisely controlled by a single external resistor and capacitor. In the stable mode the oscillation frequency and duty cycle are accurately set by two external resistors and one capacitor. The use of National Semiconductor's LMCMOS process extends both the frequency range and low supply capability.

The product brochure for National Semiconductor Corporation's LM9638 Monochrome CMOS Image Sensor SXGA 18 FPS describes a high performance, low power,$_{1/2}$" SXGA CMOS Active Pixel Sensor capable of capturing still or motion images and converting them to a digital data stream. Mega-pixel class image quality is achieved by integrated a high performance analog signal processor comprising of a high speed 10 bit A/D convertor, fixed pattern noised elimination circuits and a programmable gain amplifier. The offset and black level can be automatically adjusted on chip using a full loop black level compensation circuit. Furthermore, a programmable smart timing and control circuit allowing the user maximum flexibility in adjusting integration time, active window size, gain, frame rate. Various control, timing and power modes are also provided.

A separate listing of the above references on PTO Form 1449 and a copy of these references are enclosed herewith for the convenience of the Examiner.

The present Application is related to the following co-pending Applications: 10/893,800 filed July 16, 2004; 10/893,797 filed July 16, 2004; 10/893,798 filed July 16, 2004; 10/894,476 filed July 16, 2004; 10/894,478 filed July 19, 2004; 10/894,412 filed July 19, 2004; 10/894,477 filed July 19, 2004; 10/895,271 filed July 20, 2004; 10/895,811 filed July 20, 2004; 10/897,390 filed July 22, 2004; 10/897,389 filed July 22, 2004; 10/901,463 filed July 27, 2004; 10/901,426 filed August 27, 2004; 10/901,446 filed July 27, 2004; 10/901,461 filed July 28, 2004; 10/901,429 filed July 28, 2004; 10/901,427 filed July 28, 2004; 10/901,445 filed July 28, 2004; 10/901,428 filed July 28, 2004; 10/902,709 filed July 29, 2004; 10/901,914 filed July 29, 2004; 10/902,710 filed July 29, 2004; 10/909,270 filed July 30, 2004; 10/909,255 filed July 30, 2004; and 10/903,904 filed July 30, 2004.

The Commissioner is also hereby authorized to charge any fees required in connection with this document to Deposit Account No. 16-1340.

Respectfully submitted,

Dated: July 1, 2005

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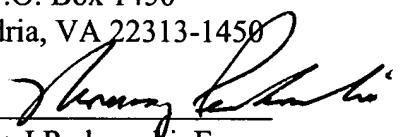

Thomas J Perkowski, Esq.
Date: July 1, 2005

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

OIPE JC14 JUL 05 2005 PATENT & TRADEMARK OFFICE

Sheet	1	of	13

Complete If Known	
Application Number	10/712,787
Filing Date	November 13, 2003
First Name Inventor	Xiaoxun Zhu et al.
Group Art Unit	2876
Examiner Name	N/a
Attorney Docket Number	108-192USA000

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	U.S. Patent Documents		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Intn'l Class / Sub Class
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EXAMINER **DATE CONSIDERED**

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(INFORMATION DISCLOSURE STATEMENT – SECTION 9 PTO-1449)